APRIL 17, 1961

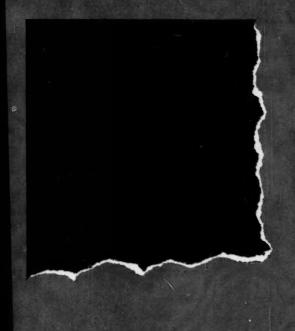
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Chemical Engineering A MOGRAW-HILL PUBLICATION

Latest inventory of new plants and facilities... 500 CPI projects
Page 167

Thermal
hydrodealkylation
promises
economy and
efficiency
Page 124







Turbine rotor on dynamic balancing machine-special photographic impression

HOW TO BALANCE "n" TURBINE VARIABLES

This rotor was designed in light of the "n" variables that affect turbine design. No one really knows the number—each installation is different. But they begin with steam pressure and temperature, exhaust steam pressure(s), horsepower and speed requirements, controls, efficiency requirements, and, of course, the nature of the individual application.

Balanced properly, these variables will produce extreme reliability—what we at Worthington believe to be the single most important factor in turbine design.

Balancing these factors in design is, of course, the work of power engineers and turbine specialists. But, it is desirable to have *every* person who is engaged in selection, operation and maintenance familiar with the

many factors in mechanical drive turbine design. To help those of your people concerned with turbine application we have just prepared "Let's Talk Turbines." It's a primer on API specifications and



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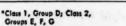
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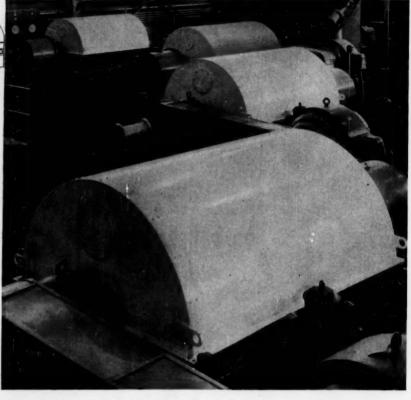
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Why BIRDS flocked to Carlsbad, N.M.



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A representative installation at Carlsbad. These Birds are fed from the flotation cells that separate the potassium and sodium chlorides. The feed contains about 40% solids and dewatered concentrate contains only about 6% moisture.



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Chemical Engineering

APRIL 17 1961

highlights of this issue

SEMIANNUAL INVENTORY OF NEW PLANTS & FACILITIES

Are the chemical process industries in a recession? Not if you base your judgment on the number of new plants and facilities included in our latest roundup (p. 167). This ten-page tabulation, covering the last half of 1960, lists over 500 individual CPI projects larger than \$200,000—25% more than in our earlier review of 1960's first half.

THERMAL VS. CATALYTIC HYDRODEALKYLATION

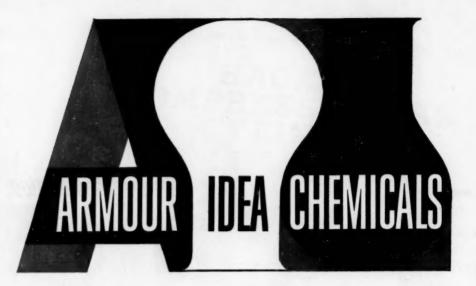
Attempting to reverse the long-time trend away from thermal to catalytic processes is a new hydrodealkylation route for making benzene or naphthalene from appropriate petroleum and coal-tar feedstocks. The thermal HDA process, recently introduced by Atlantic Refining and Hydrocarbon Research, differs radically from competing catalytic methods, as pointed out in Assistant Editor Fred Price's story (p. 128).

TESTING—(1) . . . (2) . . . (3)

Here's a new gimmick for attracting engineering talent—a do-it-yourself "aptitude" test that purportedly indicates your chances for a successful career with the sponsoring organization. Associate Editor Bill Schall took this test, reports his experiences and observations (p. 185).

NEW HELP IN TABULATING FLOWSHEET DATA

While double-entry bookkeeping may not be your cup of tea, this "ledger" format (p. 177) is just what you need to organize and present mass and energy balances for complex chemical processes. Authors Ross and Freshwater provide a clear, worked-out example of this valuable new concept.



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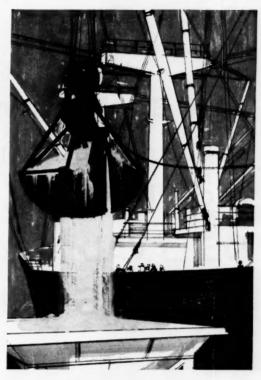
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A sound look at your own present or planned

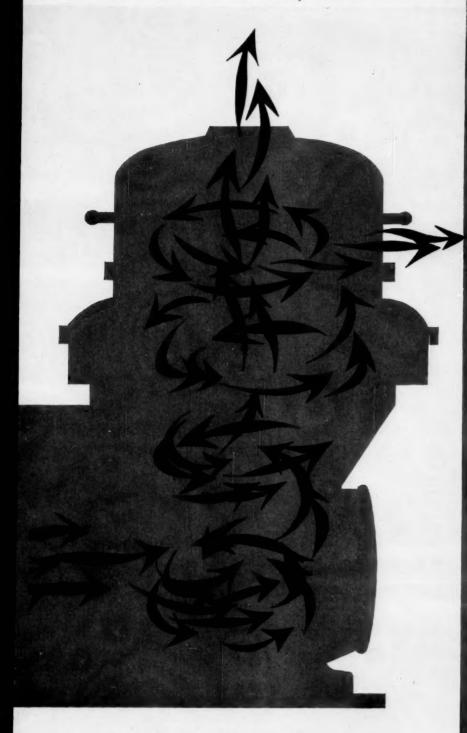












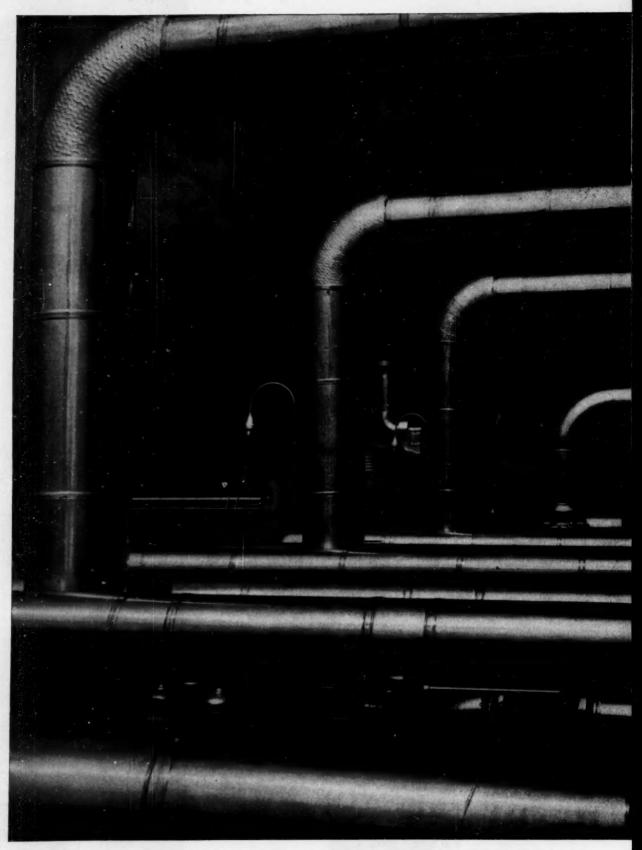
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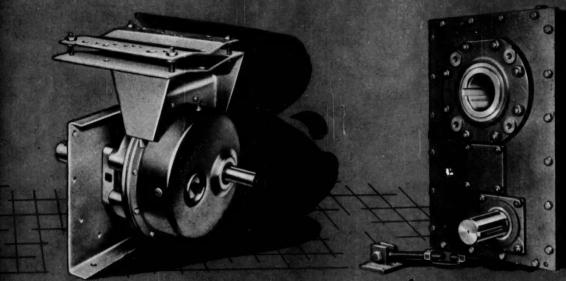
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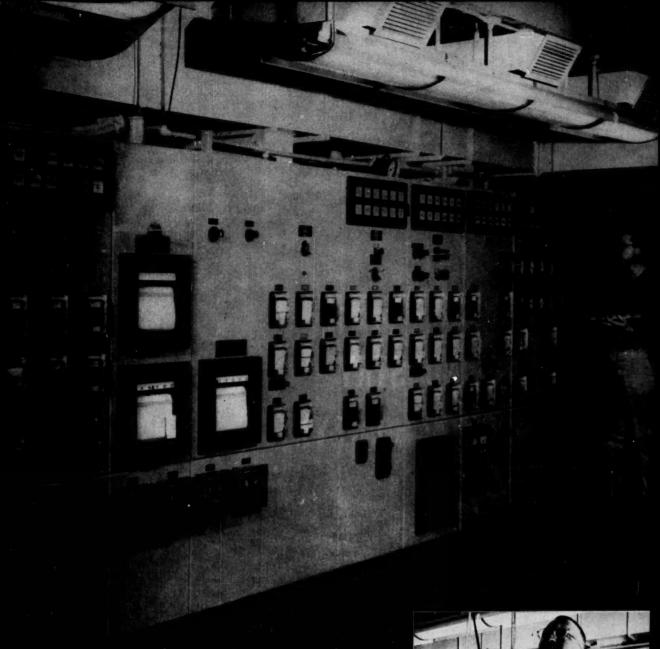
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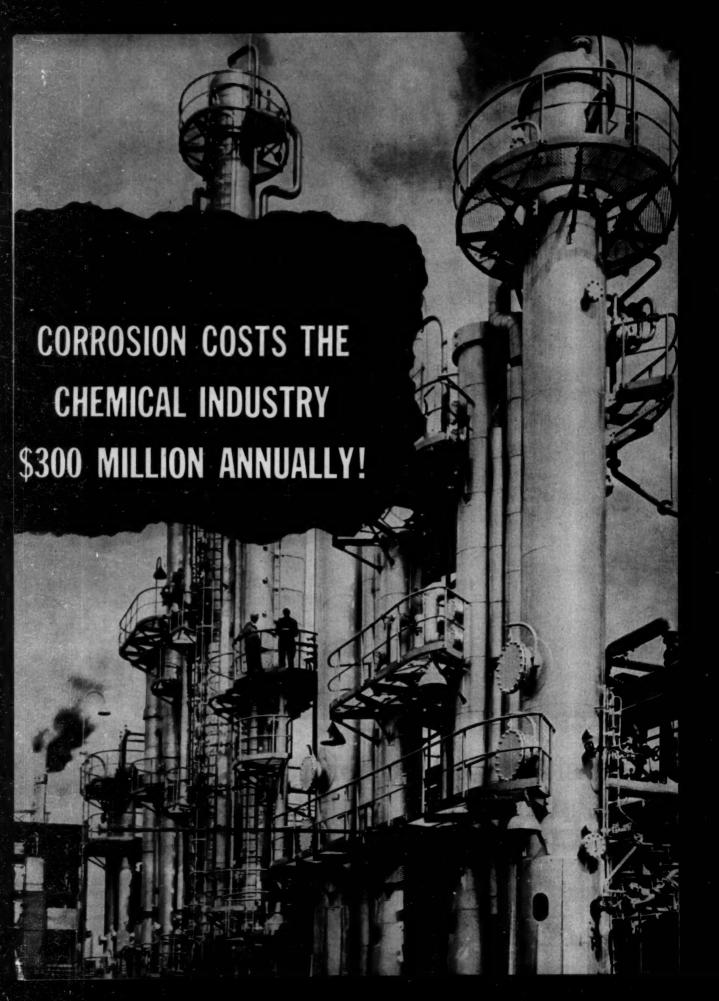
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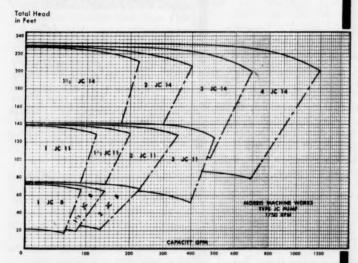
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2. VARIABLE HEAD



3. OBSTRUCTIONLESS



4. INTEGRATING



LESSON II

In order to be as handy as possible, we shall limit our discussion of the advantages of the four basic types to a single characteristic benefit.

- 1. Variable-Area: linear scale
- 2. Variable Head: flexibility

- 3. Obstructionless: obstructionless
- 4. Integrating: accuracy

LESSON III

This lesson is of the most importance as it concerns the various factors necessarily involved in the judicious selection of flowmetering devices. These primary and critical factors are: fluid property limitations, application, installation and economics. We need not go into detail on these factors since our Bulletin 91-119, a veritable gem of condensation, reviews all of these factors in the short space of only six pages. There is a limit as to how short and "handy" such a guide can be.

If you are one of those, and there are many, who philosophically opposes all "handy" guides, then we need only remind you that we make all of the four major types. Indeed, we are the only company to do so. We also wish to state that we use a wide variety of materials to construct these meters including many readout and process control devices. Our laboratories include the finest and most advanced flow measuring and calibrating equipment. A call to our field engineers can save you trouble and bring you a firm recommendation unencumbered by bias or prejudice.

TO THE RIGHT



is a sampling of some outstanding examples of each type of meter in our flowmetering line.

Variable-Area Flowmeters

Fischer & Porter has indeed made its mark in lands far and wide as the leading manufactory of variable area meters, finding itself pleasantly faced with such wide acclaim for ease of use and simplicity that it defies description. Yea, and to no surprise. Indeed our people have labored unceasingly to INTRODUCE EVERY MAJOR ADVANCE in this noble form of flowmetering, to wit: the glass tube that allows viewing the rate of flow directly; the bead-guide and Tri-Flat meter for matchless float stability; the predictable float which simplifies calculations; the metal tube for high pressures and temperatures.

Frictionless! Foolproof!

—herald the fortunate employers of the MAGNABOND coupling developed by Fischer & Porter for detecting the linear motion of the float, with abundant power to operate a multitude of accessories for recording, transmitting, totalizing and controlling. The ingenious detection system employs permanent magnets sealed into a non-magnetic, corrosion-resistant extension unit, and is widely used in conjunction with the popular FLOW-RATOR meters.

The NEW, ALL NEW MAGNARATOR

with

FLOW INDICATOR

PNEUMATIC TRANSMISSION

This amazing apparatus is distinguished as the TRUE in-line, throughflow meter. Of great joy to installation and maintenance men alike, no extension is needed and there are no

crooks, crannies or corners where material can collect. The MAGNARATOR, kin to the extension-type MAGNABOND flow transmitter, is lofted to great heights of applicability by a new magnetic coupling principle. It measures, indicates and transmits pneumatically with a linear output signal!





DP TRANSMITTER

by the wizards of Warminster

FISCHER & PORTER

Outwits PULSATION!
Outwits CORROSIVE FLUIDS!
Outwits STEAM TRACING PROBLEMS!

This popular differential pressure transmitter undeniably supports its claim as being the best in the world. Since it was first presented to the metering public its success has been remarkable. Why? Its superiority over all others is substantiated by the Facts of Actual Use!

ASTOUNDING ADVANTAGES found in no like instrument

ADJUSTABLE DAMPING in the differential sensing system, Gentlemen, which is where it should be. We warrant there to be no other method that lets you measure PULSATING flow without zero shift, PHANTOM signals, diaphragm fatigue or premature parts failure.

NEW METALS & ALLOYS such as Tantalum, 316 Stainless and Monel are STANDARD materials of construction for the sealing DIAPHRAGMS. Other "wetted" parts are fabricated from 316 Stainless, Monel, Nickel and Hastelloy C—as you desire. A perfectly sealed measuring chamber filled with the celebrated silicone oil PROTECTS ALL WORKING PARTS.

INTEGRAL STEAM TRACED PROCESS FLANGES, available from our shipping shelves, enables one to conveniently heat process connections to prevent fluids from "freezing"—all without TROUBLESOME AND EXPENSIVE lagging and tracing in the field.

Obstructionless Flowmeters

THE JUSTLY CELEBRATED

MAGNETIC FLOWMETER

OF FISCHER & PORTER one of the very best instruments ever invented



An unobstructed length of pipe that accurately measures the flow of even the least conductive fluids by the Invisible Magnetic Field. Extends the range of accurate flowmetering to heretofore unbelievable limits. A rangeability of 3000:1! Measures the flow of any liquid with a conductivity of no less than 0.1 micromho per centimeter.

Measures flow IN EITHER DIRECTION and without auxiliary equipment. Handily provides full scale recording of ANY FLOW RATE from 1 to 30 feet per second at the TURN OF A DIAL.

Fully Transistorized Recorder

Years ahead of its time! An instrument of the future which you can profitably use today. The new recorder incorporates compact transistorized circuits which have reduced space requirements incredibly. Now the entire instrument is contained in a SINGLE DEPTH CASE. No black boxes to add. All amplifiers are mounted on plug-in cards.

Gentlemen, the Magnetic Flowmeter itself represents the GREATEST ADVANCE in flowmetering in the last quarter century!

YOUR ATTENTION INVITED!

Integrating Flowmeters



TURBINE METER

Here is the zenith in flowmetering of the greatest accuracy over a wide range, designed for the most fastidious users. Each and every revolution of the bladed rotor in the TURBINE METER signifies the passage of a definite unit of fluid volume with an ELECTRICAL pulse. The total number of counts is proportional to the total volume of FLUID PASSING THROUGH the meter.

NEW! NEW! NEW



TRANSISTORIZED READOUT DEVICES

The Turbine Meter can be linked with any of an unbelievable number of Readout Devices to oversee your process operations. Exemplary devices, utilizing the most up-to-date transistorized electronic components and techniques can indicate, totalize, record and control.

Continuous In-Line Blending

NOW A FACT

Triumph at last. To the marriage of the amazing Turbine Meter and Marvelous Electronic Readout Devices goes a new distinction. Together they have brought to reality a truly Continuous In-Line Blending System for blending of two or more fluids. This combination offers to you many other solutions for conquering DIFFICULT & DEMANDING & COSTLY flowmetering operations.

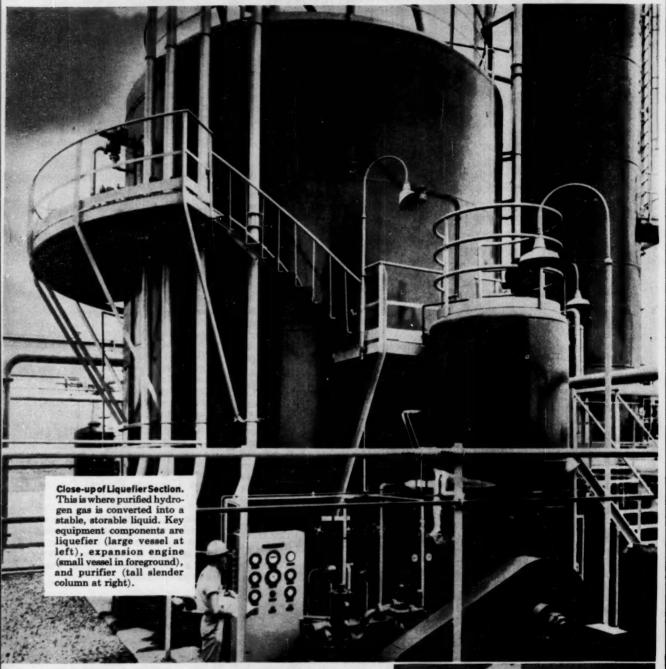
STATE YOUR PLEASURE, GENTLEMEN!

To better acquaint our public with the BENEFITS and ADVANTAGES of our UNIQUE products we have caused to be printed handsome booklets for the general edification. We will gladly post to you a selection of these works upon your application. It will only require an expression as to the type of meter(s) of interest, that is Variable-Area, Variable Head, Obstructionless and Integrating and also our "handy" Guide (91-119). We are your obedient servants in this as in all other matters.

#FISCHER & PORTER CO.

WARMINGTON COMPANY with clock in Australia Facined Grance Cormany Helland Market as well as the U.S.A.

Liquid H₂ with Trane Brazed



SPACE AGE PLANT. This multi-million dollar installation in Torrance, California, is the largest liquid hydrogen plant in the West—the second largest in the country. It is the second of five Linde plants operating or under construction primarily to meet the growing needs of the aerospace industry. And it is the first plant in the U.S.

to prove the feasibility of producing liquid hydrogen on a privately financed, commercial basis.

An important aspect of Linde's operation lies in handling the ultracold product. All piping downstream from the converter is vacuum-insulated, keeping heat leak to under 2 Btu./hr. per linear foot



installation costs in producing Aluminum Heat Exchangers

14 compact heat exchangers operate under pressures from 15 to 850 psig...temperatures down to -423°F

The new Torrance, California plant of Linde Company—division of Union Carbide Corporation—went on-stream in mid-1960. It produces 13,000 lbs. of liquid hydrogen a day—and supplies West Coast missile development centers at the rate of 3,300,000 lbs. per year under a contract awarded by the National Aeronautics and Space Administration (NASA).

Basics of the Linde process

TRANE Brazed Aluminum Heat Exchangers are used in both the purification and liquefaction phases. Entering feed gas at 250 to 300 psig. is approximately 35% hydrogen. After it has been processed through Trane Heat Exchangers, condensers, separators and an activated carbon adsorber, the impurity level is under 2 ppm.

When the hydrogen stream exits from the compression cycle at 850 psig., 90° F, it is ready to be cooled to liquefaction temperature. Two-step initial cooling brings the gas down to -315° F. Further cooling takes place against liquid nitrogen that is below atmospheric pressure—and final processing through an expansion valve brings the hydrogen down to -423° F where a portion of it liquefies. This liquid hydrogen is converted from ortho to para form, is sub-cooled, and is ready for storing and shipping.

WANT MORE FACTS? Ask your nearby TRANE Sales Office for more complete information on TRANE Brazed Aluminum Heat Exchangers. Or write TRANE, La Crosse, Wisconsin.

Lightweight, Compact, Rugged! TRANE Brazed Aluminum surface consists of corrugated aluminum sheets brazed together to form a stack of layers that provide individual passages for the flow of gases or liquids. Provides up to nine times the surface per cubic foot of shell-and-tube exchangers!



Why Linde chose Trane

TRANE Brazed Aluminum Heat Exchangers were specified because Linde wanted a dependable, compact heat exchanger surface that would give superior performance at extremely low operating temperatures. These are the same reasons more and more companies in cryogenics are turning to Trane.

Close Temperature Approaches. Approaches within 2° F could be attained with these Trane Heat Exchangers.

Low Installation and Space Costs. A typical Trane unit requires only half as much space as conventional heat transfer equipment. And this, of course, means less insulation is needed.

Low Operating Costs. The compactness of Trane Brazed Aluminum minimizes the cost of refrigeration at the extremely low temperatures required.

Trouble-Free Operation. Trane equipment is backed by thirty-two years of specialized heat transfer experience; 10 years of proved performance with Brazed Aluminum Heat Exchangers in process applications.

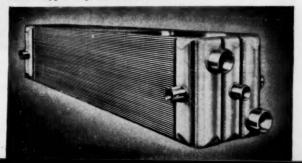
For any air condition, turn to

TRANE

Manufacturing engineers of air conditioning, heating, ventilating and heat transfer equipment

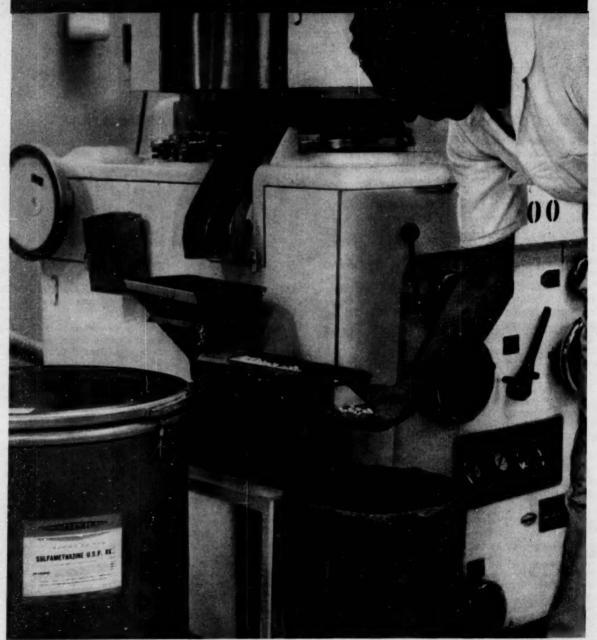
THE TRANE COMPANY, LA CROSSE, WIS. - SCRANTON MFG. DIV., SCRANTON, PA.
CLARKSVILLE MFG. DIV., CLARKSVILLE, TENN. - TRANE COMPANY OF CANADA, LIMITED, TORONTO
100 U.S. AND 15 CANADIAN OFFICES

Headered for 5-Stream Operation. The Trane Brazed Aluminum Heat Exchanger can handle as many as five fluids simultaneously. Units are available for either cross-flow or counter-flow operation. Surface can be fabricated in a wide variety of shapes and sizes to meet all types of specifications.



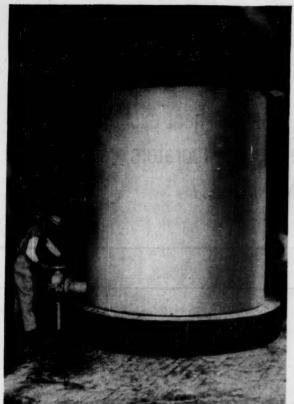
CYANAMID

Chemical Newsfront



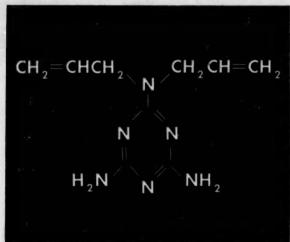
CHEMICALS BY THE CARLOAD. Fine chemicals in bulk—supplied by Cyanamid's Fine Chemicals Department. With them goes uniformity, quality and protection against variations in potency—properties "built in" by Cyanamid to assure the finest sulfonamides, antibiotics, and other products made for the pharmaceutical manufacturing industry.

(Fine Chemicals Department)



LAMINAC® POLYESTER RESIN FIGHTS OFF ACID. It costs less to solve industrial corrosion problems with Cyanamid's LAMINAC. The wash acid storage tank above is made of glass-reinforced LAMINAC—resistant to corrosion by phosphoric acid, sulphuric acid and gypsum. Tough corrosion problem? Look into LAMINAC.

(Plastics and Resins Division)

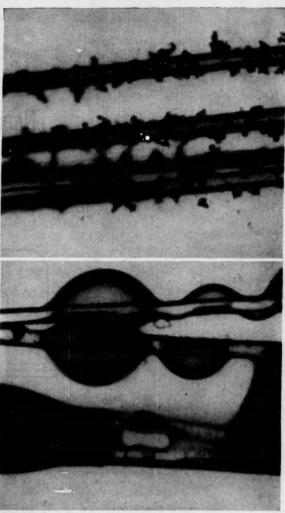


EPOXY RESIN CATALYSIS. Cyanamid's DIALLYLMELAMINE (DAM) provides fast cure for epoxy resins above 130° C, coupled with outstandingly long pot life at room temperature. The residual allyl groups may be reacted with other unsaturated systems to modify the epoxy product.

(Market Development Department)

CYANAMID

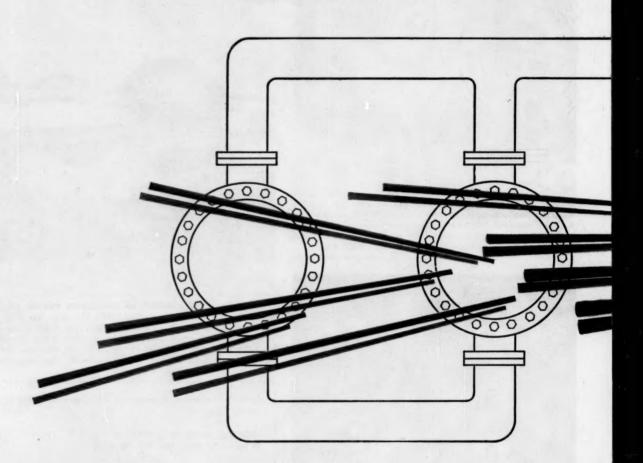
AMERICAN CYANAMID COMPANY 30 ROCKEFELLER PLAZA, NEW YORK 20, N.Y.



CYANATEX® DYEING ASSISTANT EM DYE-SOLVENT CARRIER speeds penetration of dye. Above, Cyanamid's Cyanatex has formed colored globules that attach readily to polyester fibers. There is no dye-carrier precipitate build-up as on the fibers at top. Because Cyanatex diffuses more readily into the fiber, polyesters, triacetates and acetates achieve brighter, heavier shades. (Dyes Department)

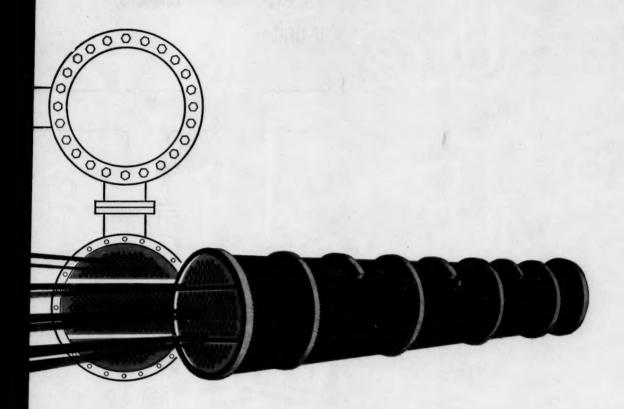
For further information on products in this advert mail this coupon to:	CE-
AMERICAN CYANAMID COMPANY	
30 Rockefeller Plaza, New York 20, N. Y.	
Dept. 6362	
Please send me additional information on	
☐ LAMINAC	
DIALLYLMELAMINE (DAM)	
CYANATEX	
Name	
Company	
Position or Title	
Position of Time	
Address	
CityZoneSt	-1-

Need tubes for heat exchangers, condensers, evaporators, coolers, feed-water units?



PHELPS DODGE COPPER-BASE ALLOY TUBES have a

Wide line of finest quality copper-base alloys for every kind of application need—including bi-metal combinations. National warehouses, completely stocked, in Houston, Beaumont and Corpus Christi, Texas, Baton Rouge and Lake Charles, La., Tulsa, Los Angeles, and South Brunswick, N. J., to serve customers from coast to coast.



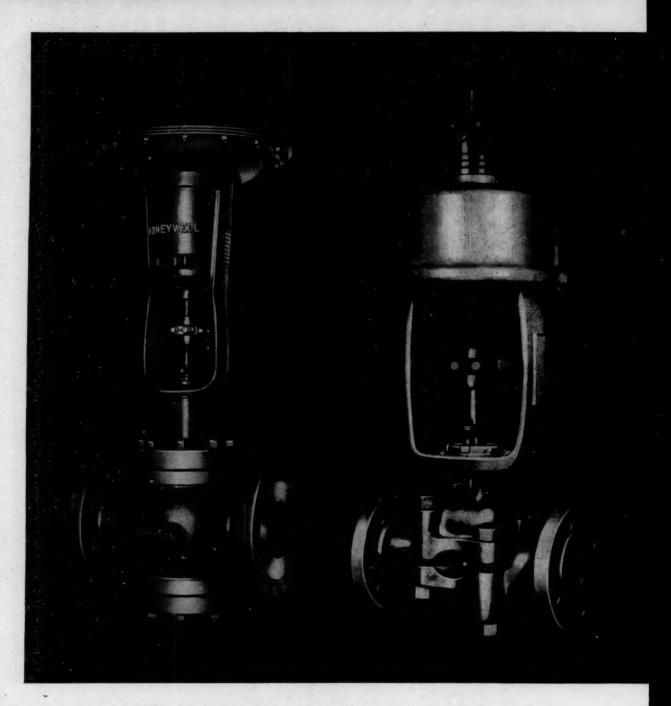
reputation for reliable "On-Stream" Performance!

Expert engineers to help you solve tube corrosion PHELPS DODGE COPPER PRODUCTS problems, select the exactly correct alloy for your applications.

Specify the best-at the same cost as the rest!

CORPORATION

SALES OFFICES: Atlanta, Birmingham, Ala., Cambridge, Mass., Charlotte, Chicago, Cincinnati, Cleveland, Dallas, Dayton, Denver, Detroit, Fort Wayne, Greensboro, N. C., Houston, Indianapolis, Jacksonville, Kansas City, Mo., Los Angeles, Memphis, Milwaukee, Minneapolis, New Orleans, New York, Philadelphia, Pittsburgh, Portland, Ore., Richmond, Rochester, N. Y., San Francisco, St. Louis, Seattle, Tampa, Washington, D. C.



The lineup, left to right—Diaphragm actuator, globe body . . . Cylinder actuator, split body . . . Diaphragm actuator, split body . . . Cylinder actuator, globe body.

Interchangeable!

MIX THEM, MATCH THEM TO THE JOB ... AND SAVE!

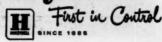
HOMEYWELL INTERNATIONAL Sales and Service offices in all principal cities of the world. Manufacturing in United States, United Kingdom, Canada, Netherlands, Germany, France, Japan.



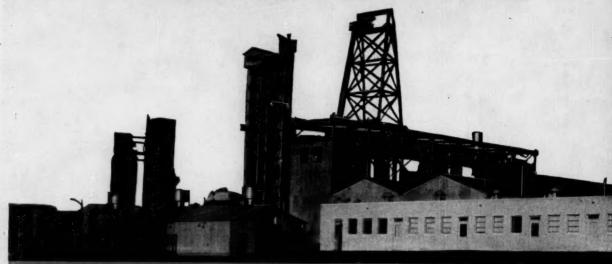
Honeywell's split-body and globe-body control valves team up beautifully with Honeywell cylinder and diaphragm type actuators. Use either actuator with either valve. The beauty lies both in the economy and perfect matching to the application made possible by this interchangeability. The "mix and match" versatility of Honeywell valves and actuators lets you select the exact degree of performance you require. No need to push a valve beyond its design limits, on one hand, or to pay for more performance than you need, on the other. You get the best valve-actuator combination for a given application, at the lowest cost. The new

Honeywell "Valve Size Computer" helps you make your mix and match selection . . . send for yours to-day. MINNEAPOLIS-HONEYWELL, Fort Washington, Pa.

Honeywell



AMMONIA



	NO. OF PLANTS	HYPROGRAM PRODUCTION		AMMON SMPLY SYNTHE	5 5%
BY-PROBUCT HYDROGEN	Organ Brand				
Acermon PLANT TASL GAS	T.	Salt Courses CO.		-0.	
NYSTOCKH-RICH REPRESY OFF-GAS				1	
A INTERNAL DATA	5 Tames Partial Children	TO D	Tank No.		200 60 American 200 Ottomon 100 Common 100 Common 100 Common
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(mon surum)	2 See Seems Contact for				350 Au
SATURAL OUS		Id Stage Sale Conversion	CC) towns		113 ban .

process installations 1945-1960



Worldwide experience with six feeds utilizing seven process sequences to produce ammonia

More than one million tons per year ammonia capacity has been built or is under contract by Foster Wheeler. Eight Foster Wheeler plants account for 20% of the tremendous increase in the production of ammonia in the United States over the last decade. The table at left provides a brief view of FW's process flexibility and worldwide experience.

The most recently completed FW ammonia plant exceeded rated capacity within one month of start-up. Economic production over a wide range of outputs has been realized. From plants of modest size, to those in the higher capacity ranges, these Foster Wheeler ammonia plants turn in exceptional performances.

Foster Wheeler has also designed and constructed two of the largest urea plants in the United States. Both use the Pechiney-Grace process featuring total recycle and produce urea of superior quality and color. To get information on the ways Foster Wheeler process experience can serve you, write to Foster Wheeler Corporation, 666 Fifth Avenue, New York 19, New York.

Heat Engineered products, plants and processes...for the world's industrial progress.

FOSTER NEW YORK LONDON



WHEELER

PARIS

ST. CATHARINES, ONT.

ONLY ONE



ONLY ONE TYPE AND SIZE FINISHING MILL WILL DO THE BEST JOB IN YOUR PLANT. THAT'S THE MILL TRAYLOR WILL BUILD FOR YOU



From requirements outlined by Standard Lime and Cement Company, Traylor engineers built this 10' x 32' two compartment ball mill for installation at Martinsburg, West Virginia. Write today and tell us the size product and capacity needed for a grinding mill in your plant. Our engineers, expert in this field, will recommend the mill Traylormade specifically to fill your requirements most efficiently... most economically.

TRAYLOR ENGINEERING & MANUFACTURING
DIVISION OF FULLER COMPANY
1551 MILL ST., ALLENTOWN, PA.

"See Chemical Engineering Catalog for further details and specifications."

THEA!

TECHNICAL REPORT

DICALITE DEPARTMENT • GREAT LAKES CARBON CORPORATION • 612 SO. FLOWER ST., LOS ANGELES 17, CALIFORNIA

Dicalite Filteraids Perform Vital Step in Uranium Oxide Production

The filtration of uranium liquors for use in the atomic energy program is one of the newer applications of Dicalite. The important point, though, is the stage at which this filtration takes place, its difficulty and its critical nature.

Kermac Nuclear Fuels Corporation operates the largest type plant of its kind in the country at Grants, New Mexico. Contrary to popular belief, they do not make charges for atomic bombs. Instead, they produce yellow cake, which contains the uranium oxide (U₃O₈) that is sold under contract to the Atomic Energy Commission.

The process, briefly, is this: The ore, a type of sandstone, is crushed and leached with sulphuric acid. The leached ore is separated into sands and slimes by cyclones, with the sands being washed in rake classifiers and the slimes being washed in coun-

tercurrent thickeners. The washing solutions from both steps are combined, and this is where filtering with Dicalite Filteraids enters the process.

These solutions carry suspended solids, some of which are practically microscopic, requiring an extremely sharp filtration for thorough removal. This thorough removal is very necessary in the processing of uranium liquors in that the effluent from the filters must have a practically zero solids content for the following solvent extraction process to be most effective, and to provide required purity in the final product. Dicalite Filteraids have proven satisfactory in this critical operation, yielding a filtrate of desired clarity.

A Dicalite engineer is well fitted to advise with you on problems in filteraid filtration, either on everyday materials or unusual applications such as this.



William P. Belford

DICALITE'S
"MAN ON THE SPOT"

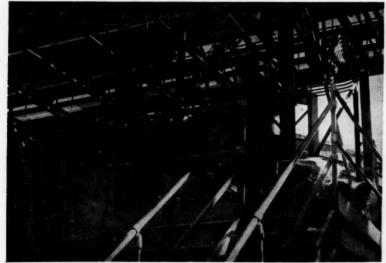
Before making specific filtration recommendations to Kermac, Bill Belford took samples of their uranium liquors to the Dicalite products laboratory at Walteria, California, for thorough preliminary tests. He also arranged to supply the Kermac laboratory with a Dicalite Bomb Filter, which is used to maintain a constant check on their filtration operations. He has worked closely with Kermac Nuclear Fuels ever since.

Before training as a Dicalite filtration engineer, Belford had an extensive background in chemical and mining engineering, with special emphasis on the technology of clays and related minerals. He studied at the University of Arizona, and was for 2 years with Gladding McBean, in laboratory control work. Deeply interested in the filtration of municipal water supply, Bill is a member of the American Water Works Association.

In addition to Kermac, Belford serves many other Dicalite customers in different industries throughout the Southwest.

TECHNICAL LITERATURE

on Dicalite Filteraids is available on request. Bulletin B-14 discusses the principles and operating practices of filteraid filtration, and its applications in many industries. Write for your copy to Dicalite Dept., 612 So. Flower St., Los Angeles 17, Calif.



Dicalite Filteraid being poured into a mixing tank at Kermac Nuclear Fuels Corporation for the filtration of uranium liquors. From here the filteraid slurry is metered by a proportioning pump into the pregnant liquor going to stainless steel pressure-type filters, where the last traces of suspended solids are removed before the liquor goes into the solvent extraction phase.



SPECIFIC WEIGHT COMPARISON AFTER 1 YEAR SERVICE IN STEAM CONDENSATE RETURN LINE

	specific pipe weight grams per lineal inch		change in specific pipe weight	
	Original Pipe	Corroded Pipe	Grams per Lin. Inch	Per Cent
Yoloy Pipe	40.3317	40.0786	2531	63%
Wrought Iron	41.3469	40.7438	6031	-1.46%

Steam condensate pH, 6.65. Pipe samples, 3/4 " nominal standard weight size.

Weight loss due to atmospheric corrosion after 3100 days exposure.

OPEN

YOLOY

9.38 LOSS

BESSEMER STEEL 18.29 LOSS

3.70 LOSS

RESISTANCE TO SOIL CORROSION
13 Soils Ranging from 2.6 pH to 9.4 pH

	CARBON STEEL		YOLOY		WROUGHT IRON	
Time (Years)	Wt. Loss*	Penetra- tion**	Wt. Loss*	Penetra- tion**	Wt. Loss*	Penetra-
2	6.1	52	4.3	41	4.8	48
5.4	11.1	81	7.2	52	8.8	75
7.4	12.1	89	9.5	79	10.9	89
9.3	17.4	88	10.6	79	12.2	97
14.3	19.7	107	11.8	93	16.3	98

* Wt. Loss, oz/ft2

**Penetration-mils (Average Max.)

SEA WATER IMMERSION TEST

10.00	Days	Wt. Loss	t. Loss Corr. Rate		Pitting-Mils	
Material	In Test	(Grams)	Mdd	IPY	Max.	Aug.
Mild Steel	2162	1439	36	.007	Perf.	128
Hand Puddled Wrought Iron	2384	1401	32	.006	Perf.	115
Mechanically Puddled Wrought Iron	2384	1247	28	.006	139	80
Yoloy	3429	1616	25	.005	90	62

SOLVED

tough corrosion problems by Yoloy Pipe at lower cost than wrought iron

Yoloy steel pipe resists corrosion better than wrought iron or carbon steel. It is rugged pipe, able to resist the corrosive bite of atmosphere, soil and chemicals. It has higher strength, more ductility, greater weldability. It is proven pipe, handling tough corrosion jobs for over 25 years.

Youngstown makes Yoloy from low carbon open hearth steel, alloyed with precise amounts of copper and nickel. Copper to resist corrosion better. Nickel to fight corrosion under both oxidizing and reducing conditions in the toughest applications.

Use Youngstown Yoloy steel pipe to solve corrosion problems above and below ground. In sewage disposal plants. Oil and chemical installations. For bridge railings. In steam condensate lines.

Next time you face a corrosion problem, order Yoloy Continuous Weld and Seamless Pipe in ½" to 12" O.D. from any Youngstown office. Or get prompt service on Yoloy pipe from any one of 900 independent distributors across the nation.

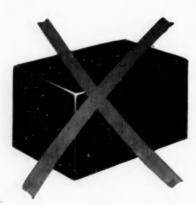


Youngstown - growing force in steel

ANOTHER

Money Saving Feature

OF Taylor Instruments



ELIMINATION OF EXTERNAL "BLACK BOXES"

Today it is no longer necessary to clutter up your instrument panels with externally mounted "black boxes" for the operation of auxiliary devices such as process alarms, slidewires, etc. With Taylor Transcopes Recorders, both pneumatic and electronic, these functions can be built into the recorder. You save money . . . and labor . . . and panel space . . . and many headaches.

The secret is Serve Power. Powerful Servomatic motors built into the recorders not only give greater recording accuracy than ever before, but also supply the power necessary for precision operation of auxiliary mechanisms and computing devices. Power in the pneumatic servo is 150 greater than in the bellows-actuated type; in the electronic, it's 1,000 greater than galvanometer systems.

With this abundant power supply you can operate integral high-low process alarms for about 1/3 the cost of separate "black boxes"; retransmitting potentiometers for half the usual price of external transducers. Function generation and digital encoding can also be accomplished within the recorders at even greater savings.

When you buy Transcope instrumentation you're buying greater accuracy than ever before available—and you're insuring against future process control needs. Ask your Taylor Field Engineer for a demonstration, or write for **Bulletin 98286** (pneumatic) or **98335** (electronic). Taylor Instrument Companies, Rochester, New York, or Toronto, Ontario.

Taylor Instruments

U.S.I. CHEMICAL NEWS

April

A Series for Chemists and Executives of the Solvents and Chemical Consuming Industries

106

U.S.I. TO BUILD PLANT FOR LINEAR POLYETHYLENE AT HOUSTON, TEXAS

Soviets Sign Agreement With N. Y. Publisher on Scientific Translations

A contract for the exclusive, worldwide English language rights to Soviet scientific books for the next six years has been signed by the official Soviet book export agency and Consultants Bureau, a New York publisher.

The books covered include important Soviet symposia, monographs, conference proceedings and collections, all on highly specialized scientific and technical subjects. The contract should result in muchimproved communications between Soviet and American scientists.

Earlier in 1960, Consultants Bureau obtained exclusive rights to translate 23 major Soviet journals in the fields of chemistry, physics, biology, medicine.

All books published by Consultants Bureau will, in the future, be made available to English-speaking scientists within six months of their publication in the USSR. Where the importance of Soviet conferences warrants even speedier dissemination of their proceedings, Consultants Bureau will publish English translations at the same time as the Russian originals appear in the USSR.

New Technique Prevents Hydrogen Embrittlement of Tantalum in CPI Equipment

Tantalum metal can be easily protected against hydrogen embrittlement via a technique developed recently. The method consists of affixing to the tantalum a small piece of platinum. The platinum is reported to protect an area 10,000 times larger than itself for over 1,000 hours.

Tantalum is a corrosion resistant metal with excellent high temperature properties. It has

shown great promise as a

New Facility Will Have Annual Capacity of 60 Million Pounds

U.S.I. will begin construction this Spring of a 60 million pound-per-year linear polyethylene plant at Houston, Texas, adjacent to the company's conventional polyethylene facilities. The new plant, which will mark U.S.I.'s entry into the manufacture of linear polyethylene, is scheduled for completion in the fourth quarter of 1962.

Zirconium Crucibles Pinch-Hit for Platinum



(Photo courtesy Fisher Scientific Company

Solid zirconium crucibles, currently only 1/6th the price of platinum, are now available for laboratory use. According to a recent report, the new crucibles permit budget-conscious labs to make large numbers of peroxide and carbonate fusions without investing in costly platinumware.

With normal care, the new crucibles are said to last for at least 100 sodium peroxide fusions at 460°C. They can be used at temperatures up to 900°C. for sodium and potassium carbonate fusions, preferably in the reducing atmosphere of a burner flame rather than in a furnace.

Nickel, iron or porcelain crucibles present the problem of sample contamination by material dissolving from their walls. With zirconium, however, it is reported that after 20 to 50 peroxide fusions, only 0.1%-2% per fusion is lost.

Recently there has been considerable discussion about over-capacity in the linear polyethylene field. Dr. Robert Hulse, general manager of U.S.I., states: "We would not be building this important new plant if we did not believe that over-capacity is a short-term problem and that linear polyethylene is growing in importance. Every market projection we have made indicates that this versatile plastic will be in short supply by early 1963."

PETROTHENE® Trade Name to Be Used

The new U.S.I. plant, designed for easy expansion, will be managed by the same people who are now running the low and medium density polyethylene plant at Houston. The linear polyethylene will be manufactured under a licensing agreement with Phillips Petroleum Company, and will be sold under U.S.I.'s trade name, "PETROTHENE®" polyethylene resin.

Linear polyethylene is stronger and more rigid than the conventional type. It

MORE

Polyethylene Mulch Film Improves Vegetable Yields

Polyethylene mulch film has increased test vegetable yields as much as 100%, according to findings of the Oregon (Corvallis) and South Dakota (Brookings) State College Agricultural Experiment Stations reported by James P. Menn, U.S.I.'s Staff Agronomist at the 73rd Annual Meeting of the Florida State Horticultural Society.

Corvallis tests on tomatoes resulted in a marketable yield of over 20 tons per acre with polyethylene mulch and about 10 tons per acre without

mulch. Other Corvallis tests showed increased pole bean

MORE

April

*

U.S.I. CHEMICAL NEWS

*

1961

CONTINUED

Polyethylene Mulch Film

and cantaloupe yields also. Tests at Brookings indicated significant yield increases for sweet corn, snap beans, carrots, cabbage and cucumbers.

Polyethylene film is said to be particularly well suited for use as mulch. Its physical properties can be varied to raise or lower soil temperatures, conserve soil moisture, control weeds and plant diseases. It is highly impermeable to water vapor. Its use often results, not only in early crop set and harvest, but also in increased marketable yields which more than justify its cost.

Polyethylene mulch is available commercially as a durable, flexible, lightweight black film. Special-purpose whitepigmented and colored polyethylene mulch films are now being researched.

Current interest is indicated by the fact that some 33 land grant colleges are carrying on, or have completed, research projects on plastic mulch materials. However, it is reported that if such materials are to become widely used, more study will be needed on improving application equipment.

A copy of Mr. Menn's paper is available from U.S.I.



The plant at left was grown with polyethylene mulch film, the one at right without. Note healthier look, greater yield.

CONTINUED

Tantalum

material of construction for the chemical process industries. However, use of tantalum has been limited in certain applications because it is subject to stress cracking and failure due to hydrogen ion absorption into the metal lattice. In tests over the past three years, small platinum spots riveted or spot welded to tantalum have protected the latter metal from concentrated hydrochloric acid at 374°F. for over 1,000 hours. By contrast, unprotected tantalum becomes brittle in a few hours.

Tantalum's rate of corrosion is not increased by contact with the platinum, it is reported. In fact, in some cases, it is decreased. At the same time, the platinum's rate of corrosion, usually high in concentrated hydrochloric at high temperatures, is decreased to almost zero.

It is felt that the new development will greatly increase the utilization of tantalum metal for chemical plant equipment.

CONTINUED

Linear Polyethylene

is widely used for blow-molded bottles and containers for industrial products, detergents and other household staples. Other growing markets include injection molded items such as toys and housewares; extruded pipe; and film for heavy duty bags and similar products.

Company Makes Wide Range of Resins

U.S.I. facilities for conventional polyethylene have a rated capacity of 300 million pounds annually. The company currently produces some 100 types of 36 basic low and medium density resins at plants in Houston and Tuscola, Ill. Linear resins are also currently available from U.S.I. pilot plant facilities and through resale arrangements.

TECHNICAL DEVELOPMENTS

Information about manufacturers of these items may be obtained by writing U.S.I.

Plastic laboratory ware is subject of new catalog which includes many items not previously available in plastic, such as Buchner-type filter funnels and 125 ml. Erlenmeyer flasks. Special section on polyethylene properties. No. 1700

Color-coating of all types of metals in single treatment is now claimed possible with new chemical surface treating process now ready for commercial application. New coatings can be clear or colored; are reported color-fast, corrosion-resistant, easy to apply.

K-t-butyl alcoholate now available in pilot plant quantities. Is essentially alcohol-free. Said to have found wide use as catalyst in base-catalyzed reactions on research scale. No. 1702

New line of metering pumps for drums and pails has just been introduced. Pump for 5- and 6-gallon pails is self-priming, dispenses 4 oz. per stroke.

Pump for 15-, 30-, 55-gallon drums dispenses 8 oz. per stroke.

No. 1703

Metal cleaner now on market is formulated to remove build-up of iron and nickel oxides from tanks, lines, nozzles, fittings in sulfuric acid or nickel sulfate service. Said to be non-fuming, weakly acidic.

Four new instrumentation systems, based on nuclear methods, have been developed for continuous measurement and control of moisture and density of materials on conveyor belts and in pipes, bins, hoppers, tanks, mixers, blenders.

No. 1705

Cryogenic ball valves now on market handle hydrogen, oxygen, helium, nitrogen—as liquids. Vacuum-jacketed types furnished when extreme low-temperature storage with minimum heat leak is required. Claimed extremely tight-sealing. No. 1706.

New foaming agent for use in air drilling of oil wells beset by water encroachment is said to produce large quantities of stable, light-density foam and to be unaffected by high concentrations of dissolved solids. No. 1707

New spray gun for applying heavy thickness floor coatings said to give smooth, even coat of catalyzed coatings mixed with fillers such as silica and aluminum oxide. Coatings can be sprayed from 1/16 in. up to any thickness. No. 1708

Interchangeable type system for typewriters, now on market, allows use of about 400 characters not on standard typewriter, without installing new type keys. Includes chemical and mathematical symbols, Greek letters, subscript and superscript numbers.

PRODUCTS OF U.S.I.

PETROTHENE® . . . Polyethylene Resins

MICROTHENE . . . Finely Divided Polyethylene Resin.

Organic Selvents and Intermediates: Normal Butyl Alcohol, Amyl Alcohol, Fixel Oll, Ethyl Acetate, Normal Butyl Acetate, DIATOL®, Ethyl Ether, Acetane, Ethyl Chicroformate, Ethylene, Sodium Ethylate, Urethan U.S.P. (Ethyl

Pharmecautical Products: DL-Methionine, N-Acetyl-DL-Methionine, Urethan USP, Intermediates.

Ethyl Alcohol: Pure and all denatured formulas; Anhydrous and Regular Proprietary Denatured Alcohol Solvents SOLOX®, FILMEX®, ANSOL®M, ANSOL®R

Heavy Chemicals: Metallic Sodium, Anhydrous Ammonia, Ammonium Nitrate, Nitric Acid, Nitrogen Fertilizer Solutions, Phosphatic Fertilizer Solution, Sufferic Acid, Caustic Soda, Chlorine, Sodium Peroxide.

Animal Feed Products: DL-Methionine, MOREA® Premix (to authorized mixer-distributors).

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U.S.I. SALES OFFICES

Allanta • Baltimore • Boston • Chicago • Cincinnati • Cleveland Detroit • Kansas City, Mo. • Los Angeles • Louisville • Minneapolis New Orleans • New York • Philadelphia • St. Louis • San Francisco Clear Water Pumps — Double suction pumps designed for utmost efficiency in clear water service. Ruggedly built for dependability, minimum maintenance and down time. Send for Bulletin 955.

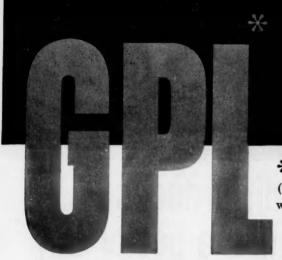
High Pressure Pumps
— Ideal for boiler feed and other severe clear water service. These multistage pumps operate against heads to 1500 ft. Capacities to 900 gpm. For complete facts, write for Bulletin 980.

Close-Coupled Pumps — These efficient pumps save space, simplify installation. No need for shaft alignment. Vertical or horizontal models. Adjustable discharge angle. Write for Bulletin 975.

WEW! Bullato! Hermetic Pumps
— Quality pumps with special
bearings for use where leakage
would be dangerous or costly. Available in
a broad range of materials of construction.
Write for full details.

Non-Glogging Pumps — Mave high consistency liquids dependably and efficiently. Minimize wear and wedging. Inspection simplified by diagonally split shell. Rubber-lined models for moving abrasive or corrosive liquids. Send for Bulletin 953.

Chemical Liquid Pumps
— Specially designed for moving most corrosive abrasive or high consistency liquids. Your choice of many types in a variety of trim. Will withstand punishing conditions. Write for Bulletin 976.



Heat Transfer Pumps — These special Huffaln Pumps are designed to handle high temperature liquids. Job-engineered construction includes required alloys, water-cooled bearings and proper packings. Single suction, solid shell design gives peak efficiency. Write for complete details,

*True long-range pump economy depends on GPL (Gallons Per Lifetime)...pumped day-in-and-day-out with a minimum of down-time and maintenance costs.

This is the kind of long-lived reliability built into every 'Buffalo' Pump. It is the most important result of top quality design and construction.

'Buffalo' offers a complete line of centrifugal pumps featuring parts interchangeability and low maintenance. Whatever your liquid moving needs, chances

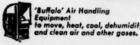
are there's a 'Buffalo' Pump to fit it perfectly. And your 'Buffalo' resident engineer is the man to recommend it. Contact him, or write us direct.



BUFFALO PUMPS DIVISION

BUFFALO FORGE COMPANY

Buffalo, New York Canada Pumps Ltd., Kitchener, Ontario





'Buffalo' Machine Tools to dri punch, shear, bend, slit, notch and cope for production or plant maintenance,



Buffalo' Centrifugal Pumps to handle most liquids and slurries under a variety of conditions.



Squier Machinery to process sugar cane, coffee and rice. Special processing machinery for chemicals.



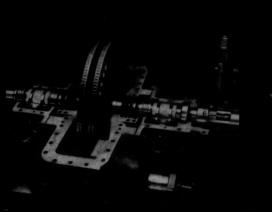
Six marked differences make Elliott turbines a better buy

Why are Elliott YR turbines your best choice for mechanical drives? Some of the reasons are described on the opposite page. These are tangible reasons why you can expect dependable, economical operation with little care or attention. With more than 50 years' experience in mechanicaldrive turbines up to 50,000 hp; with the most complete line of field-proven machines; with engineering and service facilities nationwide: Elliott is clearly "Turbine Headquarters." Write for bulletin H22-D.



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GENERAL OFFICES: JEANNETTE, PENNSYLVANIA PLANTS AT: Jeannette and Ridgway, Pa.; Springfield, Ohio TURBINES • GENERATORS • MOTORS • COMPRESSORS TURBOCHARGERS • EJECTORS • STRAINERS • TUBE CLEANERS



Frecise alignment at shall diminiple frue centerline support, permits smooth and dependable operation at all operating temperatures.



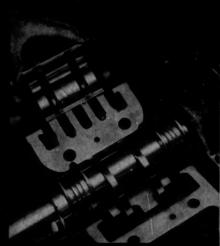
Simple, positive that the fact among a form is dependable, weather proof, accurate. Separate trip gives positive overspeed protection.

These features mean dependable, economical turbine operation:

- 1. True centerline support
- 2. Positive speed control
- 3. Accessible shaft seals
- 4. Inexpensive bearings
- 5. Optional hand valve
- 6. Full protection



Accessible shall and finding to manufacture and routine inspection. Covers readily



installed with no suraping litting or dissimunt required.



Steam saving and take and proof where it is offered against full steam pressure, reduces steam consumption at protein local.



All-weather protection is abundant for Illiam VE aritimes. They strug off heat, snow, moisture, dust or contaminated atmosphere.

CELANESE POLYMER COMPANY

announces a new engineering material

CELCON

ACETAL COPOLYMER

Celcon is an entirely new Celanese plastic offering advantages over metals and other fabricating materials in many applications. Celcon has a unique combination of properties, including high structural strength over a broad temperature range, excellent moldability, resistance to corrosion and creep, fine color and surface. Best of all, in extensive laboratory and field tests, Celcon performed at a high level with long-range stability. Celcon promises to answer the need for a material in which you can design with greater confidence!





Product of Radically New Molecular Architecture

Celcon is a result of extensive Celanese experience in polymer chemistry. It makes possible new concepts of material use; it is a new

design medium.
Celanese maintains strict control of
Celcon production, from raw materials to finished polymer. Celanese is
the world's largest producer of trioxane—basic monomer of Celcon production. Celcon is now available for
your evaluation in developmental
quantities on a restricted basis.

Celcon Meets the Challenge of the Materials Age

- Combines low cost with high strength and rigidity
- Easily fabricated—injection molded, extruded, machined
- Resistant to a wide range of chemicals
- Resistant to high temperatures
- High creep resistance even at elevated temperatures
- Excellent colorability
- Unusual versatility in molding
- Broad molding range

Uses as Varied As Industry Itself

Celcon, as a fabrication material and styling medium offers many advantages over metals and other materials for a wide variety of applications, such as timing gears, door handles, pipe and plumbing, sporting goods, automotive parts, electrical applicance parts, machinery housings and components, pump parts and impellers. But these are only an indication of where this versatile new engineering material can be used to both product and cost advantage.

Celanese® Celcon®

For complete details, please write, outlining your application, to: Celanese Polymer Company, Dept. P-170-D, 744 Broad Street, Newark 2, N. J.

Celanese Polymer Company is a Division of Celanese Corporation of America

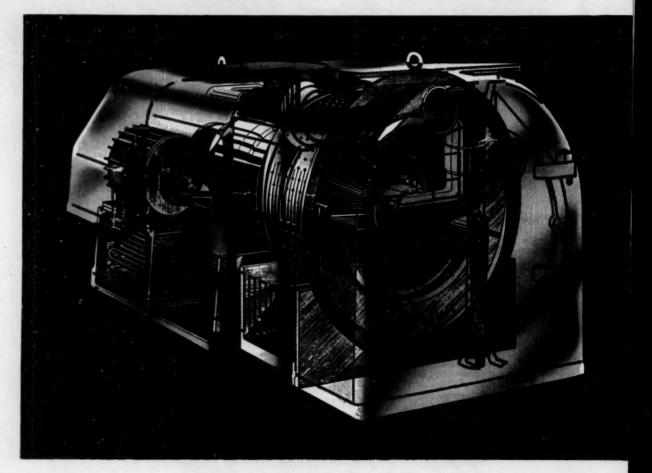
BAKER PERKINS CENTRIFUGALS

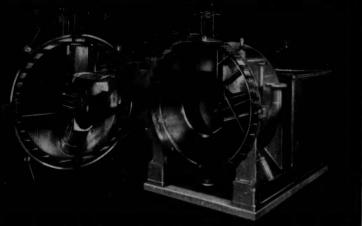
FOR ECONOMICAL SEPARATION OF FILTERABLE SOLIDS

Baker Perkins centrifugals have an enviable reputation for efficiency and economy in centrifugation. The well known Baker Perkins continuous pusher type and automatic universal centrifugals have been used successfully for years to separate many different filterable solids. Now with a multi-stage continuous pusher type centrifugal and an automatic vertical pusher type centrifugal, there is a Baker Perkins centrifugal to separate both slow draining solids and extremely fragile crystals. All Baker Perkins centrifugals are manufactured in many sizes, many different materials of construction and with special design features to meet your process requirements.

B-P (ESCHER-WYSS) MULTI-STAGE CENTRIFUGALS

Continuous centrifugation of difficult-to-handle materials is now possible with new B-P (Escher-Wyss) Multi-Stage Continuous Centrifugals. The continuous multi-stage pusher centrifugal eliminates cake buckling, assures adequate retention time, speeds release of liquids, improves washing, provides better separation of multiple liquid components and reduces power consumption. Models are available with capacities from 1½ tons to 45 tons per hour.



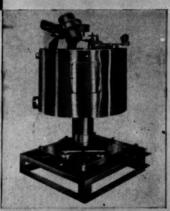


PRESSURE CENTRIFUGALS

The B-P HS 40W is one of a line of pressure centrifugals built for normal operation at 1000 times gravity and pressures up to 150 PSIG. Many new features include: a self-seating, self-aligning door seal, housings that withstand extreme operating pressures, new type discharge knife and chute, and a peeler knife that enters the cake at successively increasing depths, thus eliminating cake glazing.

VERTICAL CENTRIFUGALS

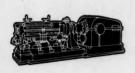
The new Baker Perkins VS-20 Vertical Centrifugal is designed and built to handle friable crystals during charging without danger of crystal degradation. The unit is charged with slurries while running at reduced speeds, then automatically accelerates for the drying and washing operations and automatically decelerates for discharge.

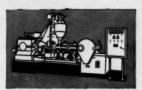


CONTINUOUS CENTRIFUGALS

The B-P Type S Centrifugal has continuous feed and discharge requiring no timing or cycle controllers. It is ideal for centrifuging a wide range of relatively free-draining crystalline materials. Friable solids are handled easily since there are no scrapers, baffles, rakes or plows to cause crystal degradation. Models are available with capacities up to 54 tons per hour of solids.

BAKER PERKINS INC.



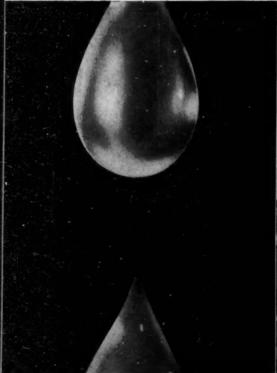




CONTINUOUS MIXERS . PLASTICS MACHINERY . UNIVERSAL MIXERS

SAGINAW, MICHIGAN

ideas and news:





Nothing leaks in...or out of Electri-Cand pumps: Built without packing, stuffing box or seals, the pump-motor unit is completely fluid tight. Safely handles a wide variety of corrosive, toxic, and precious fluids without danger of contamination or loss. Liquid being pumped cools the motor, lubricates the bearings. Maintenance costs are low.

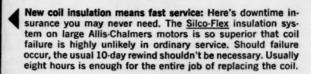
More high quality lime — less fuel: The <u>Grate-Kiln</u> System produces consistent high quality lime using 15% less fuel per ton of product than a conventional rotary kiln. <u>Grate-Kiln</u> Systems increase lime yield from limestone feed—outproduce conventional rotary kilns of the same overall length by 50%. Incorporated is a new high efficiency cooler which transfers maximum recuperated heat to secondary combustion air for kiln and preheater grate.

Which of these productive ideas could be working for you?

A control unit that saves space. A pump that pumps practically any solution. These examples demonstrate the extra value that is a standard with A-C... the greater efficiency and the added productivity which are yours when you buy A-C products, systems and services. Call your Allis-Chalmers representative for details on A-C "worth-more" features. Or write Allis-Chalmers, Industrial Equipment Division, 907 South 70th Street, Milwaukee 1, Wisconsin.

Electri-Cand, Shelter-Clad, SpaceMaker, Pyro-Shield, Silco-Flex, Grafe-Kiln and Compactor are Allis-Chalmets trademarks,





Compact, 30-inch vibrating mill: Can actually outproduce a conventional tumbling mill 15 to 30 times per unit volume . . . is powered by just two 50-hp motors. Grinding media occupy 80% of mill's 12-cu.-ft, capacity, grind wet or dry materials as fine as two microns, as coarse as 48 mesh. Adaptable to grinding in inert atmosphere, can be utilized for closed or open-circuit grinding.





So low, two fit where one used to go: This new SpaceMaker control center is the first completely new 2- to 5-kv motor controller development in more than a decade. Two-high design can cut floor space needs in half. Full drawout construction makes it the safest, most easily accessible controller available. Flame-retardent, track-resistant Super Pyro-Shield insulation adds reliability. Walk-in Shelter-Clad enclosures available for outdoors.

A-C INDUSTRIAL EQUIPMENT DIVISION: motors, control, rectifiers, pumps, compressors, crushers, grinding mills, screens, kilns, coolers, dryers, Compactor mills, industrial systems.

OTHER A-C PRODUCTS: thermal, hydro and atomic electrical generating equipment, switchgear, transformers, unit substations, tractors, earth-moving equipment, engines, lift trucks.

ALLIS-CHALMERS

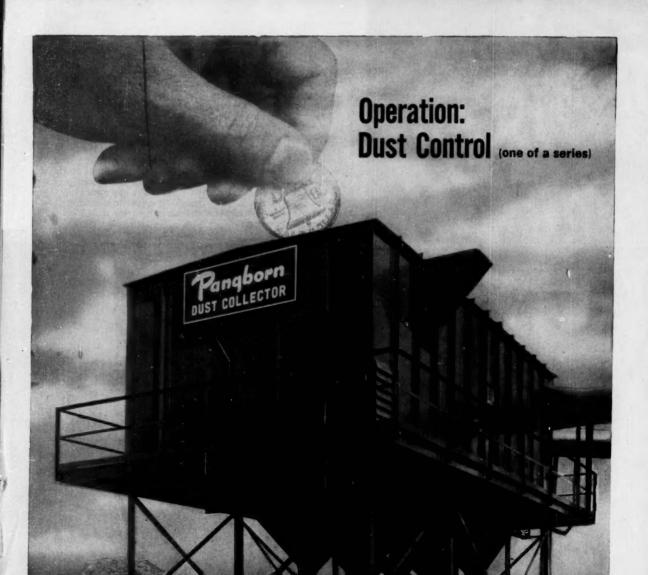
Nothing leaks in...or out of <u>Electri-Cand</u> pumps: Built without packing, stuffing box or seals, the pump-motor unit is completely fluid tight. Safely handles a wide variety of corrosive, toxic, and precious fluids without danger of contamination or loss. Liquid being pumped cools the motor, lubricates the bearings. Maintenance costs are low.

More high quality lime — less fuel: The <u>Grate-Kiln</u> System produces consistent high quality lime using 15% less fuel per ton of product than a conventional rotary kiln. <u>Grate-Kiln</u> Systems increase lime yield from limestone feed—outproduce conventional rotary kilns of the same overall length by 50%. Incorporated is a new high efficiency cooler which transfers maximum recuperated heat to secondary combustion air for kiln and preheater grate.

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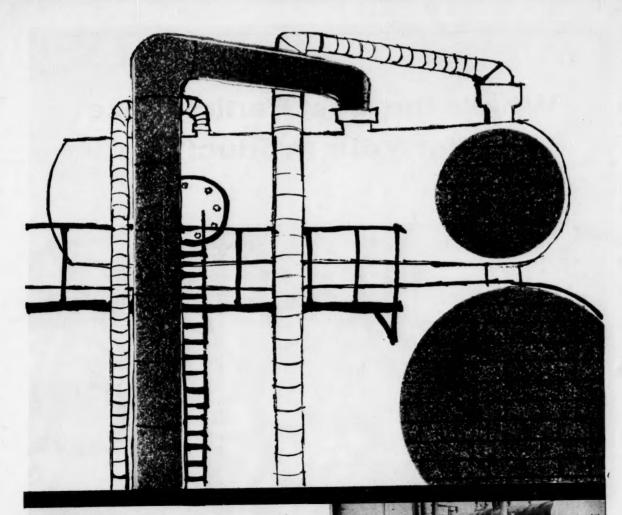


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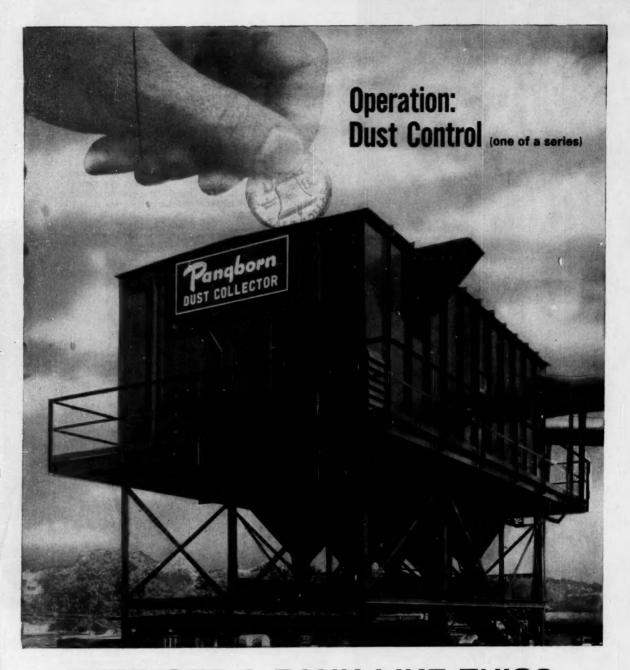
OTHER A-C PRODUCTS: thermal, hydro and atomic electrical generating equipment, switchgear, transformers, unit substations, tractors, earth-moving equipment, engines, lift trucks.

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Salvaged dust can mean money in the bank. And Pangborn Dust Control equipment works quickly and efficiently to reclaim valuable dust for you.

Yet salvage opportunities are only a part of the savings offered you by Pangborn Dust Control equipment. It also eliminates health hazards in your plant and makes for better housekeeping; it removes abrasive or corrosive dusts that can endanger machinery; and it increases the efficiency of your employees and improves community relations.

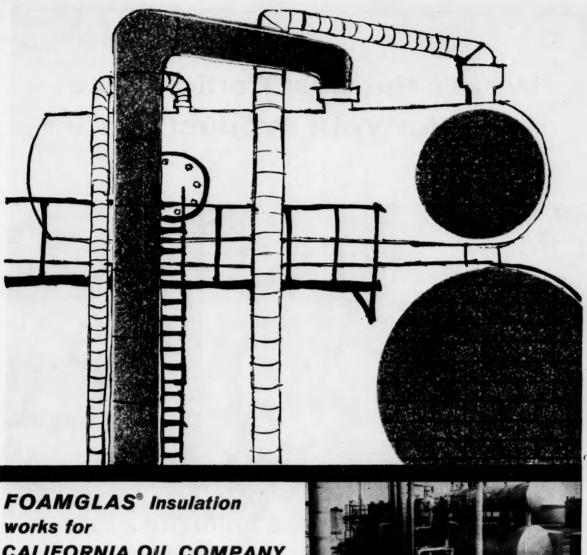
Pangborn has the right Dust Control equipment for all

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Pangborn of HAGERSTOWN

April 17, 1961—CHEMICAL ENGINEERING



CALIFORNIA OIL COMPANY

EVIDENCE: In 1951, California Oil Company selected FOAMGLAS Insulation for their alkylation plant at their Perth Amboy, New Jersey, refinery. Ten years later FOAMGLAS is still delivering consistent service, temperature control and fire protection on reactors, drum exchangers, and piping in the complex high octane blending operation.

Long-lasting, trouble-free insulation is a result of the completely waterproof nature of FOAMGLAS. The inorganic insulation ignores moisture, keeps a constant K-value and lasts for the life of the equipment. The closed glass cell composition holds temperatures at the required 30°F to 60°F in outdoor alkylation units and piping.

Another important benefit for California Oil is the incombustibility of FOAMGLAS, reducing fire hazards. And FOAMGLAS protects against smoke, dirt and acids in the refining operation.

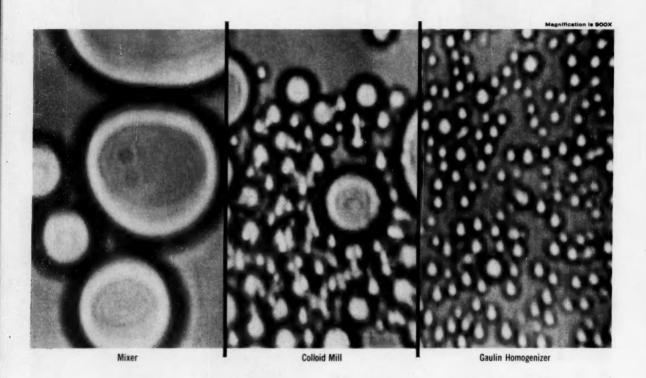
Let FOAMGLAS solve your most demanding insulation problem above or below ground, indoors or out, on piping, tanks, equipment, valves or fittings. For more details, write to Pittsburgh Corning Corporation, Dept. H-44, One Gateway Center, Pittsburgh 22, Pa. In Canada: 3333 Cavendish Blvd., Montreal, Quebec.

Pittsburgh Corning makes available a complete line of accessory materials for use with FOAMGLAS. Write for Data Sheets.

PITTSBURGH



What's the Best Particle Size for Your Product?



Gaulin Technical Assistance will give you the answers

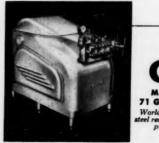
You can make important changes in the chemical and physical properties of your product simply by controlling its particle size.

A slight size reduction in dispersing, emulsifying or blending will change everything from its color to its taste, the speed with which it chemically reacts, and almost every other property it has.

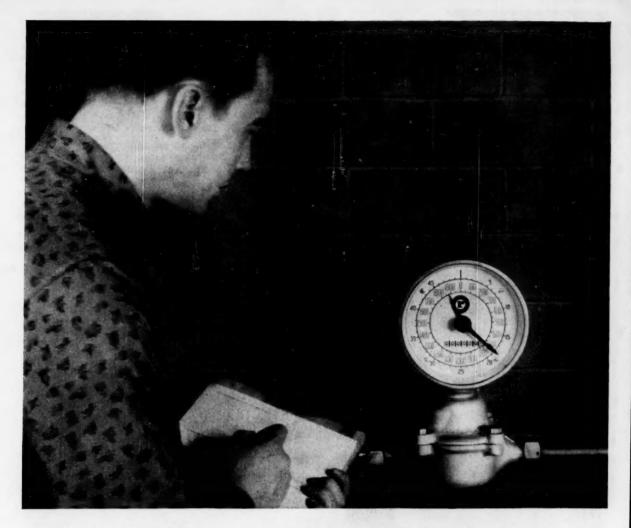
Gaulin Technical Assistance gives you a chance to fully explore the advantages of various particle sizes—to find the best energy level (type of equipment) for your product.

And since we manufacture a complete line of homogenizers, colloid mills and submicron dispersers, we can provide you with the best means for achieving the particle size you desire. Gaulin Technical Assistance starts with the GTA Library of Product Information. Ask for special bulletins prepared on each type of equipment. Then call on Manton-Gaulin for our specialized Technical Assistance. There's no obligation.

See Chemical Engineering Catalog for address of your nearby Manton-Gaulin Representative.



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Have you considered that your company can save important money by using modern measurement methods to control the flow of industrial liquids? With *low cost* Rockwell meters you can guard your liquid inventories. You can batch, blend and control formulas. You'll have accurate records of costs. And with Rockwell meters fitted to Rockwell *automatic control valves* you can save time and money on repetitive operations.

We invite you to investigate all the advantages of liquid metering in your plant. Rockwell meters are sold by leading jobbers everywhere.

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Write us for his name or just use the handy coupon. Rockwell Manufacturing Company, Dept. 130D, Pittsburgh 8, Pa. In Canada: Rockwell Manufacturing Company of Canada, Ltd., Box 420, Guelph, Ontario.

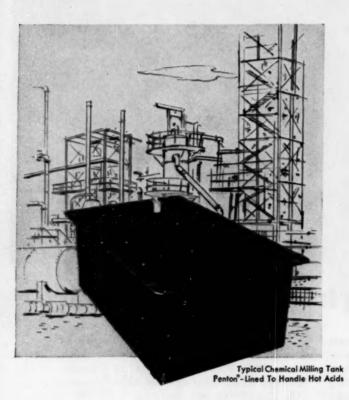
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City		ZoneState	



GAR-LINE PENTON TANK LININGS

for Corrosion Resistant Service



New GAR-LINE Penton Tank Linings offer economical, high-temperature protection against corrosion. Where only more expensive materials were previously used, GAR-LINE Penton Tank Linings are proving their ability to perform as well as—and better—in many corrosive exposures at high temperatures.

Unique Properties. Mechanically, GAR-LINE Penton Tank Linings exhibit excellent tensile strength at high temperatures, good dimensional stability and low water absorption . . . Chemically, they resist all inorganic acids except fuming nitric and fuming sulfuric.

Applied by these carefully selected and authorized applicators:

ABRASION & CORROSION ENGRS. 1205 N. McMasters Street Amarillo, Texas AUTOMOTIVE RUBBER CO., INC. 12580 Beech Road Detroit 39, Michigan BARTHEL CHEMICAL CONST. CO., INC. P.O. Box 1025 Tacoma 1, Washington BELKE MFG. CO., INC. 947 N. Cicero Avenue Chicago 51, filinois BITTNER INDUSTRIES, INC. 91 Diaz Street P.O. Box 10265 Prichard, Alabama BUCKLEY IRON WORKS 21 Christopher Street Dorchester, Massachusetts BUFFALO LINING & FABRICATING CORP. 73 Gillette Avenue Buffalo 14, New York CHEMICAL PROOF OF SEATTLE 625 Alaska Avenue Seattle, Washington CORROSION TREATMENT CORP. P.O. Box 125 ELCHEM ENGRG. & MFG. LTD. P.O. Box 249 Burlington, Ontario, Canada ELECTRO CHEMICAL ENGRG. & MFG. CO. 750 Broad Street Emmaus, Pennsylvania FLORIDA CORROSION CONTROL 2939 W. Beaver Street P.O. Box 10082 Jacksonville 7, Fls. THE FORTUNE COMPANY 1100 W. 37th St. North Wichita 4, Kansas GALIGHER COMPANY 545 West 8th—South Salt Lake City, Utah GOLDEN PLASTICS CORP. 333 East 8th St. Oakland 6, California

GOODALL RUBBER COMPANY 2050 N. Hawthorne Avenue Melrose Park, Illinois HANSZEN PLASTICS COMPANY 835 S. Good-Latimer Expressway Dallas, Texas HEIL PROCESS EQUIPMENT 12901 Elmwood Avenue Cleveland 11, Ohio HUNTINGTON RUBBER MILLS of PORT COQUITLAM B.C., Canada INNER-TANK LINING CORP. 4777 Eastern Avenue Cincinnati 26, Ohio MAURICE A. KNIGHT Kelly Avenue Akron 9, Ohio MERCER RUBBER CORPORATION Highway 46, Cor. Huyler Little Ferry, New Jersey METALWELD, INC. Scotts Lane & Abbottsford Rd. Philadelphia 29, Pennsylvania PARKER BROTHERS, INC. 7044 Bandini Blvd. Los Angeles 22, California PLASTICS APPLICATORS, INC. 7020 Katy Rd. P.O. Box 7631 Houston 7, Texas PROTECTIVE COATINGS 1602 Birchwood Avenue Ft. Wayne, Indiana RUBBER ENGINEERING & MFG. CO. P.O. Box 2335 Salt Lake City 10, Utah RUBBER MILLERS, INC. 707 S. Caton Avenue Baltimore, Maryland CO.
625 S. Sarah Street
St. Louis 10, Missouri STEBBINS ENGRG. & MFG. COMPANY

GARLOCK

For more information, contact the applicator nearest to you. Or, write for data on Penton; information also available on Teflon Anti-Stick and Teflon Tank Linings. Special Products Dept., Garlock Inc., P.O. Box 612, Camden 1, New Jersey.

*Registered Trademark, Hercules Powder Company †Registered Trademark, The Du Pont Company



add NORFOLK, VIRGINIA... to the growing list of TGS local distribution terminals for MOLTEN SULPHUR.

And how does Norfolk keep its 20,000 gross ton storage capacity stocked well ahead of demand?

By our new 15,000 ton tanker, the Marine Sulphur Queen, which on a 10 to 12 hour turn around schedule takes on cargo at our new large main supply terminal at Beaumont, Texas. From Norfolk we are supplying Mid-Atlantic plants by tank car and tank trucks.

As part of a broadening program of molten sulphur deliveries, TGS is now operating several large distribution terminals located in major sulp consuming areas.

Carteret-molten • Cincinnati-molten Norfolk-molten, solid . Tampa-molten, solici Other terminals are in the planning stage.



TEXAS GULF SULPHUR COMPANY

75 East 45th Street, New York 17, N. Y. 811 Rusk Avenue, Houston 2, Texas

Sulphur Producing Units:

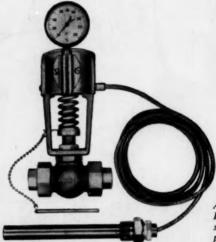
NEWGULF, TEXAS • MOSS BLUFF, TEXAS • FANNETT, TEXAS

SPINDLETOP, TEXAS • WORLAND, WYO. • OKOTOKS, ALBERTA, CANADA

(PHOTO): The MARINE SULPHUR QUEEN heading into Norfolk.

immediate

AMERICAN TEMPERATURE REGULATORS begin corrective action with less than 1/10 degree change at the bulb



American Temperature Regulators are made in sizes ½" to 4". Temperature ranges as low as minus 15° F. to 50° F.—as high as 240° F. to 350° F.

response

You get fastest possible temperature response from these new regulators because the stem cannot bind and retard valve action.

The valve stem on American Temperature Regulators is sealed off by a friction-free bellows that makes practical a nonleaking packless valve. Also contributing to fast, stable action is the use of an extra-long preflexed adjusting spring. This spring permits a long range of temperature adjustment without disturbing valve sensitivity at normal levels.

There are other high-quality features in American Temperature Regulators: maximum use of stainless steel; standardized parts; the fewest possible components; and unitized assembly. In addition, compactness simplifies installation in "tight" locations.

Accurate temperature regulation and attentionfree operation mean long-term economy. Your industrial supply distributor will gladly help you select the right American Temperature Regulators for your needs. Write for Bulletin 114A.



AMERICAN TEMPERATURE REGULATORS

A product of

MANNING, MAXWELL & MOORE, INC.

Gauge and Instrument Division . Stratford, Connecticut

Canada: Manning, Maxwell & Moore of Canada, Ltd., Galt, Ontario Latin America: Export Division, Chrysler Building, New York, N. Y. Europe: Manning, Maxwell & Moore, S. A., Fribourg, Switzerland



has the only complete service that means

Worter

From top to bottom, you can depend on Layne for the most complete water service in the industry. This complete service provides undivided respon-

quality and in the quantity required. Over 75 years of growing service gives the skill and technical knowhow which makes Layne First in the field of water. For additional information write for bulletin 10.

LAYNE OFFERS COMPLETE WATER SERVICE:

Initial Surveys • explorations • recommendations • site selection • foundation and soil-sampling • well drilling • well casing and screen • pump design, manufacture and installation • construction of water systems • maintenance and service • chemical treatment of water wells • water treatment—all backed by Layne Research.

Layne services do not replace, but coordinate with the services of consulting, plant and city engineers.

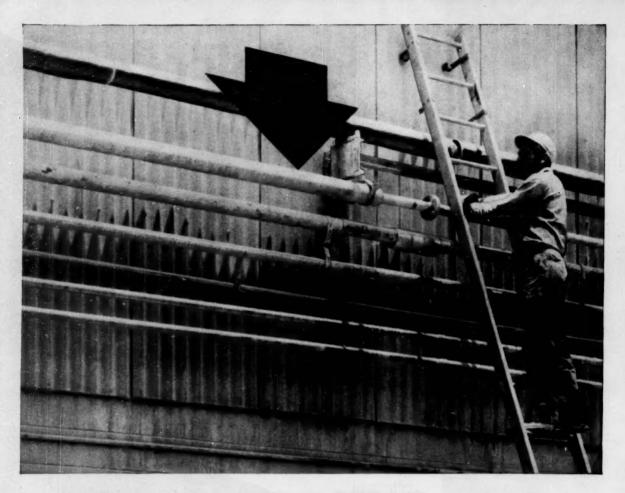


LAYNE & BOWLER, INC., MEMPHIS

General Offices and Factory, Memphis 8, Tenn.

LAYNE ASSOCIATE COMPANIES THROUGHOUT THE WORLD

SALES REPRESENTATIVES IN MAJOR CITIES



Resistant Ni-o-nel alloy quadruples service life of line handling "wet process" phosphoric acid

Lasts four times longer. Resistant Ni-o-nel* nickel-iron-chromium alloy has outlasted the best material previously used for this pipe, by a margin of four to one. This pipe handles "wet process" phosphoric acid, at Virginia-Carolina Chemical Company's Nichols, Florida plant. Acid concentration is 55% P₂O₅. Temperature is 200°F. Acid contains small amounts of dissolved impurities—calcium sulfate, fluorides, iron and aluminum.

Experience at other plants:

Ni-o-nel alloy cylinder and baffle plate in submerged combustion evaporators. Concentrate 29% to $54\%\ P_2O_5$. Impurities include 1-3% sulfuric acid, 1-2% fluorides, 3-20%

suspended solids. Temperature range is 220°-280°F.

(Ni-o-nel alloy has stepped up the life of these parts 3 to 5 times.)

Ni-o-nel alloy cone sections of venturi scrubbers. Used in producing 48-50% phosphoric acid from elemental phosphorus. Temperature range of 175-200°F. High agitation.

(Ni-o-nel alloy metal losses have reached a maximum of 0.0065 ipy in pure runs. In runs containing a high percentage of fluorides and other impurities the high was 0.014 ipy.)

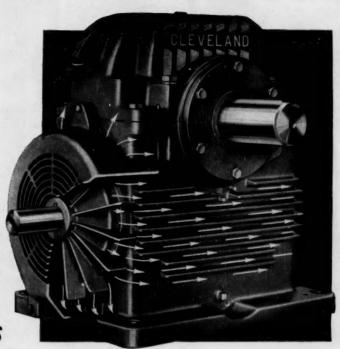
In pure phosphoric acid, Ni-o-nel alloy resists all concentrations and temperatures up to and including a boiling 85% solution. It is successful, for example, in equipment polymerizing hydrocarbons by phosphoric acid catalysis. Also, in the heating coils used in applying phosphate coatings to steel.

Have you a phosphoric acid corrosion problem? If so, send for a copy of our Technical Bulletin T-37, "Engineering Properties of Ni-o-nel." This informative publication contains practical information about corrosion resistance, fabricating procedures, welding, available mill forms, mechanical properties, and physical constants.

HUNTINGTON ALLOY PRODUCTS DIVISION
The International Nickel Company, Inc.
Huntington 17, West Virginia

NI-O-NEL.

Fan cooling for Increased HP Capacity is Not New... to users of Cleveland Speed Reducers



As far back as 1944, Cleveland Speedaire Worm Gear Reducers (shown in both the announcement ad and cutaway photo below) were providing industry twice the load carrying capacity then available from standard worm gear units of equal frame size. Even then, it was fan cooling that did the trick—because fan cooling was and still is the most practical method of heat dissipation.

On the new, higher horsepower Cleveland's (shown in top cutaway photo), a small, specially designed fan—equally effective in either direction of rotation—is located on the worm shaft's input side. Fan size and design permit a smooth, more effective flow of air beneath, above, and around all sides of the reducer.

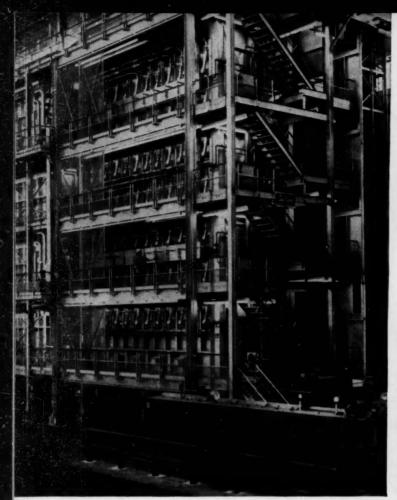
Mounting the cooling fan on the worm shaft INPUT end is a very definite Cleveland advantage for when the

fan is mounted on the *opposite* side, a second oil seal is needed. This results in additional friction loss due to seal drag—and is another point where oil leakage could occur.

Remember, it was Cleveland design engineers who pioneered both fan cooling and centrifugal casting of bronze gears—and after sixteen years of rugged field usage in all types of industrial plants, have now incorporated these features in all units (from 3 to 12-inch centers) of the new standard Cleveland Speed Reducer line.

Get the story of these new speed reducers from your Cleveland representative, or write today for free 36-page illustrated Bulletin No. 410 that contains complete engineering information. Either way, you will get the answer to improved speed transmission—at savings of 50% or more on per horsepower cost!





A view of the U.S. Steel's giant annealing furnace in Pittsburg, Calif. Coils are welded together so that a mile-long strip is constantly moving through the series of heating, soaking and cooling zones in roller-coaster fashion at speeds up to 1500 feet per minute.



Anaconda A-X flexible connectors installed at roll-shafts absorb thermal expansion and contraction and seal in inert gas furnace atmosphere.

Anaconda A-X stainless steel flexible connectors on flue-gas lines compensate for thermal expansion and contraction.



ANACONDA A-X FLEXIBLE CONNECTORS PROTECT PIPING, SEAL ROLL-SHAFTS IN LARGE ANNEALING FURNACE



Continuous strip annealing furnace temperatures cause a variety of movements due to thermal expansion and contraction. To absorb this movement in flue-gas lines and to provide shaft seals on rolls, Surface Combustion Division of Midland-Ross Corp., designers and builders of U.S. Steel's giant furnace, installed hundreds of Anaconda A-X stainless steel flexible connectors.

Anaconda A-X Tubing is a flexible metal connector designed to handle

the types of movement shown at left while conveying liquid and gas over a wide range of temperatures. It is available in stainless steel and other alloys and is generally sold complete with fittings. Nominal tubing I.D.'s: 5", 6", 8", 10", 14". For complete details, write for Bulletin A-X 97 or call your Anaconda Metal Hose representative. Anaconda Metal Hose, Box 791, Waterbury 20, Conn. In Canada: Anaconda American Brass Ltd., New Toronto, Ont.

ANACONDA METAL HOSE



now try this one for SIZE! A 7000 cfh* line-mounted Rootsmeter less than 18" long

Now you can have the advantages of both rotary-positive-displacement metering and line-mounting in a 7000 cfh Rootsmeter, Model 7M125, as well as in the already widely accepted 3000 cfh model.

Rootsmeters are accurate through wide ranges of pressure and flow—unaffected by fluctuations. And because of Roots proved operating principle, you can be sure the accuracy is permanent.

The new meters are designed for easy line-mounting. The 7000 cfh model is less than 18" long, and the 3000 cfh model is only 14" long. Connections are flanged to ASA C.I. standards, and line-mounting Rootsmeters require no special supports for simple horizontal or vertical installation.

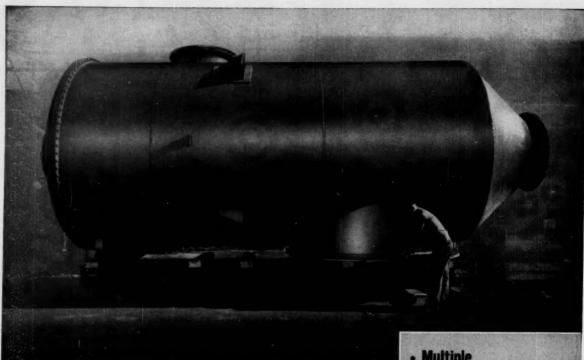
There are a lot of other advantages in these Line-Mounted Gas Meters, too. You can easily read total flow through the convenient protective lens of the direct-reading volume register, yet the register itself is enclosed entirely within the meter case, eliminating problems incurred with external counters. And if you wish, the meter can be easily instrumented. Maintenance is simple: just replenish the oil occasionally; convenient bulls-eye oil-level gauges make checking easy. There are no internal valves, orifices, or diaphragms to wear or be damaged, and no stuffing boxes to maintain. Testing is easy too, with simple connections provided for standard proving procedures.

Whether your problems are in gas production, transmission, or distribution, or if you meter industrial or institutional gas, you'll find Line-Mounted Rootsmeters the most accurate and dependable, easiest to install, and most convenient gas meters you've ever used. Call your Roots-Connersville engineer or write for details of all the advantages of new Line-Mounted Rootsmeters.



ROOTS-CONNERSVILLE BLOWER DIVISION

900 W. MOUNT STREET, CONNERSVILLE, INDIANA In Canada—Roots-Connersville Blower (Canada) Ltd., 629 Adelaide Street, West, Toronto



MANHATTAN RUBBER LINED TANKS for PERMANENT Protection against Corrosion and Contamination

Costly process equipment for storing and handling corrosives deserves the degree of protection possible only with specially compounded, acid-proof Manhattan Rubber Linings. Thick, multiple calendered sheets of natural or synthetic rubber assure maximum durability under rough working conditions. The linings expand and contract with the tank metal under temperature changes . . . won't harden or crack. Their protection against most acids and alkalis is as fool-proof as 65 years of advanced technology can provide.

All Manhattan Rubber Linings are bonded to metal so securely actual tests have proved they can't be separated! And every Manhattan lined tank is tested under high voltage to assure flawless protection before being shipped to your plant. If your equipment is too large to ship to Manhattan, skilled crews will do the job at your location.

Be sure of permanent protection for your process solutions and equipment. Let an R/M representative show you the advantages of Manhattan Rubber Lined tanks, pipe and process equipment. Contact the Manhattan Rubber Lining plant or sales office nearest you... or write direct.

- Multiple
 Calendered Sheets
- Permanent Protection Against Corrosion, Contamination
- Permanent Rubberto-Metal Bond
- Resistant to Acids, Alkalis, Abrasion, Temperature
- Largest Facilities
 Longest Experience
- Rubber Lining Plants
 at Passaic, N. J.
 North Charleston, S. C.

Write for Catalog No. 7115

RM 1000

RAYBESTOS-MANHATTAN, INC.
MANHATTAN RUBBER DIVISION, PASSAIC, NEW JERSEY



ENGINEERED RUBBER PRODUCTS . . . MORE USE PER DOLLAR

"Made OF Stainless Steel ... Made BY Jenkins"

Valve Performance Shows the Big Difference in that Spec!

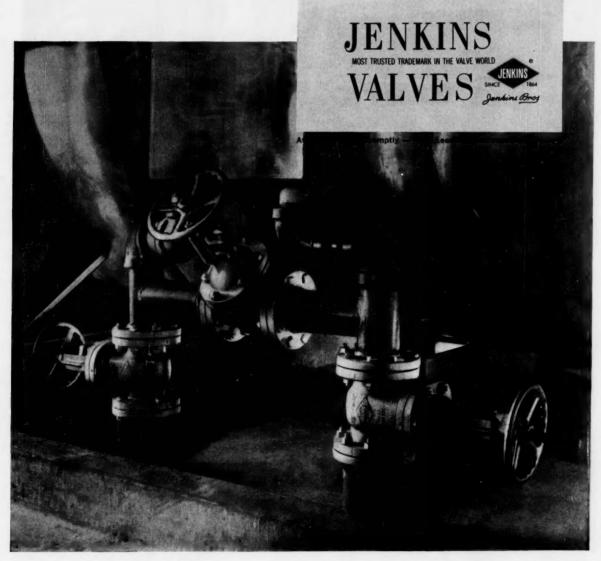
When service conditions require valves of Stainless Steel, remember that metal is only part of the answer to long, dependable valve performance.

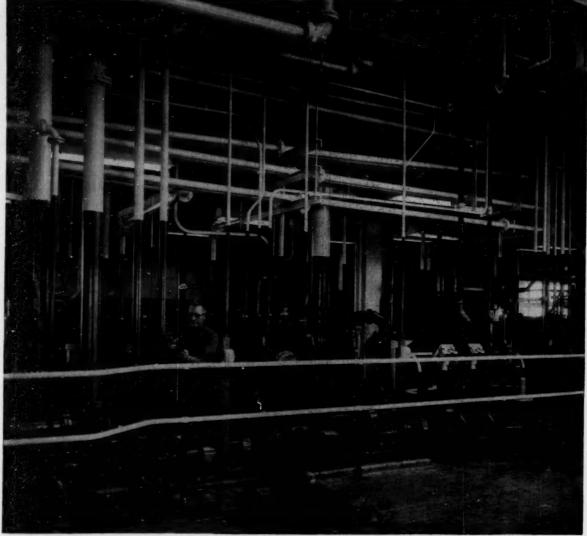
The WAY valves are made is equally important. Factors you can't even see make a big difference. Such factors as perfection of castings... precision machining... painstaking inspection and testing... sound design. Most important of all: the maker's guiding policy about quality.

To be sure about all these critical factors, experienced

specifiers and buyers specify JENKINS as well as the metal alloy when Stainless Steel valves are needed. It is well-known that for almost a century Jenkins has made valves to *just one* standard of quality . . . the highest. At Jenkins every operation, every worker is aimed at fulfilling that standard, whatever metal a valve is made of.

SEND FOR NEW CATALOG 59-SS of Jenkins Stainless Steel valves in types and alloys to satisfy most needs. Jenkins Bros., 100 Park Ave., New York 17.





Toms River Chemical Corporation, Toms River, N.J.

SARAN LINED PIPE—no failure after 10 years carrying hot acid loads

Thousands of feet of pipe carry a constant flow of corrosive acids, wet chlorine, sodium hydroxide . . . at temperatures ranging as high as 185° F. . . . where downtime can't be tolerated. Here in the dyestuffs plant of Toms River Chemical Corporation, Toms River, N.J., Saran Lined Pipe delivers its reactive loads year-in, year-out, and needs no time out for repairs.

"Even after 10 years, Saran Lined Pipe needs no replacement or repair," say company officials. "The only maintenance has been cleaning and exterior painting, with occasional servicing of the saran lined valves. For our plant conditions, this is the best, most economical carrier for most of the acids and chemicals we use—HCl, H₂SO₄, SO₂,

Cl2, NaOH, and others.

"Unlike other kinds of piping, we can easily cut and assemble Saran Lined Pipe in the field. When errors in measurement occur, they cost far less to correct with Saran Lined Pipe than with other kinds."

For carrying even the most corrosive of chemicals, consider Saran Lined Pipe. Saran Lined Pipe, fittings, valves and pumps are available for systems operating from vacuum to 300 psi, from below zero to 200° F. They can be easily cut, modified and fitted in the field without special equipment. For more information, write Saran Lined Pipe Company, 2415 Burdette Avenue, Ferndale, Michigan, Dept. 1564AK4-17.

THE DOW CHEMICAL COMPANY



Midland, Michigan



emergency

maintenance fund for DEMING PUMPS

Special maintenance on your Deming pumps probably won't cost you a nickel! Years of trouble-free performance is the rule; emergencies rarely occur.

Dependable Demings save you money in other ways, too. When routine servicing is performed, spare parts inventory is light because Deming parts are standardized and readily interchangeable. Plant expansion costs less because Deming pumps are designed for adaptation to your growth requirements.

Deming rotary and sump pumps, end suction and vertical immersion process pumps are of special interest to the processing industries. For complete descriptive literature, just mail the coupon.

THE

DEMING "

Overseas distributorship available in some areas. Write to Department C for details.

Please send me	catalogs	on: (type	9)	pumps
for (application)				
NAME				
ADDRESS				
CITY	7	ONE	STATE	



dustophobia...



ITS CAUSE AND CURE—There are three schools of thought on the cause of Dustophobia. Psychologists say it's psychological, physicians claim it's physiological. We side with the third viewpoint which holds that people hate dust because it's just plain dirty! The cure? Again a divergence of opinion. Hypnosis has been suggested by the psychologists; antihistamines proposed by the physicians. Our solution? Get rid of the cause... with Ducon Dust Collectors, naturally! There's a Ducon cyclone, scrubber or filter for almost every dust control application. They are efficient... economical... and a sure cure for Dustophobia. Particularly in the vicinity of your plant. Send for Bulletin A-9159 describing Ducon's Line of Dust Recovery equipment.



SEL-REX RECTIFIER HELPS MAKE THE "LUBES" THAT KEEP MISSILES FROM BEING EATEN ALIVE!

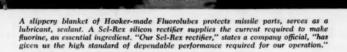
At Hooker Chemical Corporation's Niagara Falls, N.Y. plant, a Sel-Rex rectifier supplies the current for an electrochemical operation important to the U.S. Space Program. It is production of fluorine, basic element of Hooker Fluorolubes®.

Polymers of trifluorovinyl chloride, Fluorolubes are made as non-flammable light oils, heavy bodied oils and greases. Their job is to protect missiles from their own corrosive chemical fuels—the metal-eating, highly-destructive action of pure oxygen, hydrogen peroxide and concentrated nitric acid.

According to Robert F. Schultz, production manager of Hooker's Eastern Chemical Division, the unit supplying current to the fluorine cells must provide uninterrupted, trouble-free service. To date, his Sel-Rex silicon rectifier "has met all expectations; it has proven completely reliable, presenting no maintenance problems and requiring little or no attention."

And for your special current needs—for reliable, continuous conversion of A.C. to D.C.—choose Sel-Rex, the industry-proved rectifiers that more than pay for themselves in unequalled dependability and maintenance-free service.

Send for Free "GUIDE" to Industrial Rectifier Equipment



Complete Semi-Conductor Power Conversion Equipment and Systems for any AC to DC Application



THE MEAKER COMPANY

SUBSIDIARY OF SEL-REX CORPORATION

Nutley 10, New Jersey

Factories and offices Chicago 50, Ill., Los Angeles, Cal. and Nutley 10, N. J.

Representatives in principal cities.



Carlson Type 304 stainless steel plate was fabricated into the reactor vessel by Combustion Engineering, Inc. This plate must withstand the high temperatures and severely corrosive conditions associated with nuclear service.

Carlson specialists, working exclusively with stainless steel, maintain the precise quality standards essential in meeting critical service requirements. Whether you build nuclear power plants, missiles, or corrosion-resistant process equipment, you will find at Carlson a production and on-time delivery service you can trust. We will be glad to work with you on your projects. Write, wire or phone for detailed information.

If you would like a copy of our new booklet, "Producing Stainless Steels . . . Exclusively," please let us know. Enrico Fermi Atomic Power Plant, Lagoona Beach, Michigan. Reactor section built, owned, and will be operated by Power Reactor Development Company. Conceptual design by Atomic Power Development Associates, Inc. Detail design and construction of reactor vessel by Combustion Engineering, Inc. The turbine-generating plant is built, owned, and will be operated by The Detroit Edison Company.

PHOTO COURTESY OF POWER REACTOR DEVELOPMENT COMPANY

G.O.GARLSON Inc.

Producers of Stainless Steel

134 Marshallton Read THORNDALE, PENNSYLVANIA District Sales Offices in Principal Cities



Plates • Plate Products • Heads • Rings • Circles • Flanges • Fargings • Bars and Sheets (No. 1 Finish)

Conspicuous by its Performance



Air Power—100 lb. Variety—The kind that is economical, dependable... That's what you get with a compact Clark Balanced/Opposed Air compressor. You may hide it in the basement or the boiler room, but this smooth running veteran will always be conspicuous by its performance.

Efficiency at All Key Points—Compressor cylinders utilize large, streamlined air passages and optimum number of valves to minimize pressure drop, turbulence and valve losses. The heavy duty Simplaire valve has only one moving part on the low pressure suction side. Its webbed disc valve ring is opposed by minimum spring force, operates with less total differential pressure than any other compressor valve design. The Clark intercooler is carefully engineered for highest possible heat transfer rates. Double wall construction provides a large surge chamber to minimize pressure drop and assure maximum delivery of air.

GLARK DI DRESSER INDUSTRIES INC.
OIL . GAS . CHEMICAL ELECTRONIC . INDUSTRIAL

A Real Space Saver—Squeeze it into "impossible" places . . . install large amounts of horsepower in limited areas. Compact Clark design with overhung integrally supported rotor makes the most of available space, eliminates bulky extension shafts with outboard bearings and flywheel.

Perfect Running Balance—Clark Balanced/Opposed design cancels out primary and secondary unbalanced forces. Units run smooth and quiet, thereby easing wear on moving parts. Foundations need only be large enough to support the physical weight of the compressor. You can locate a Clark machine anywhere... with confidence.

Low, Low Maintenance—Internal components are easy to get at, easy to service. Clark Simplaire valves are ultra simple in design, can be readily installed, or disassembled and cleaned. Valve bodies and housings of like size are completely interchangeable for suction or discharge, offer no alignment problems.

Put Greater Efficiency into every compressor dollar you spend. Contact your nearest Clark representative for full details, or write for Bulletin 185.

CLARK BROS. CO., OLEAN, N.Y.

NEW BELLOWS FLOW TRANSMITTER

gives you field indication plus convenience and precision

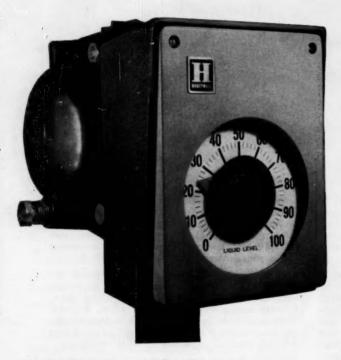


You get all the economy and convenience of pneumatic transmission and all the efficiency of the bellows meter body plus field indication, when needed, in the new Honeywell Bellows Flow Transmitter. Use it in any application to transmit flow or liquid level measurements in open or closed tanks.

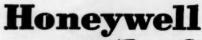
This new meter has automatic ambient temperature compensation and two-way overload protection for 100% of span. Maintenance is greatly simplified by modular construction which lets you remove any major component by loosening two screws. All field adjustments are easily accessible, and a self-locking feature prevents upset after calibration adjustments are made.

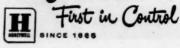
You can change ranges in the field simply by removing a single spring assembly and replacing it with an assembly of the desired range . . . adjust damping quickly and accurately, while the instrument is in operation . . . install the meter with either vertical or horizontal piping, so that it vents, drains and purges itself. The meter transmits with calibrated accuracy of $\pm 0.5\%$ of full scale, and indicates within $\pm 1.0\%$ of full scale.

For complete details on the new Bellows Flow Transmitter, call your nearby Honeywell field engineer. Or write MINNEAPOLIS-HONEYWELL, Wayne and Windrim Avenues, Philadelphia 44, Pa.—In Canada, Honeywell Controls, Ltd., Toronto 17, Ontario.



New Bellows Transmitter is available with a concentric scale or as a non-indicator. It has 16 ranges—from 0-10 inches of water to 0-400 inches of water.





April 17, 1961—CHEMICAL ENGINEERING



"Strike up the band... the versatility, uniformity, and dependability of Esso solvents have made them a leader in the field. Applicable in chemical processing, and in the formulation of surface coatings and plastics, Esso solvents help assure you of uniformly high-quality end products. They are delivered fresh from conveniently located storage terminals. Technical assistance from Esso Sales Service Laboratories, backed by the world's leading research laboratories, is yours for the asking. Call your Esso Representative or write to us at 15 West 51st Street, New York 19, New York. (And tell 'em Nosey sent you!)" Nosey

ESSO STANDARD, DIVISION OF HUMBLE OIL & REFINING COMPANY (\$550)





LOOK INTO... ECO CENTRI-CHEM PUMPS

Impellers fully enclosed or semi-open. Handle slurries up to 1/18" particle size.

Capacities to 40 gpm, heads to 50 ft. Low cost, heavy duty pumps in optimum materials of construction—Carpenter 20 stainless steel or Hastelloy* B or C.

> Time proven, chemically inert mechanical seal— Teflont or carbon in combination with ceramic or Hastelloy B or C and Carpenter 20.

Offered in two types —integral motor mounting or ball-bearing pedestal mounting (illustrated).

ECO

the big-name in small pumps for the process industries



CENTRI-CHEM LINE



ALL-CHEM LINE



Write for Literature on any or all of the Eco stock pumps shown below for handling corrosive or hazardous processing fluids.

*Union Carbide Trademark. † du Pont Trademark.

GEARCHEM LINE



ECO ENGINEERING COMPANY . 12 New York Avenue . NEWARK 1, N.J.



The reason: Over 70 years of manufacturing experience? Yes, that helps. But even more important is our more-than-70-year record of working with the bicarb-consuming industries to see that each user gets the proper grade to meet his needs exactly. Why don't you try. . .

Wyandotte Bicarb

ANOTHER DOTTE

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STATE						tte Bicarbonate carload quanti-		

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WYANDOTTE, MICHIGAN

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WYANDOTTE CHEMICALS

Pacing Progress with Creative Chemistry

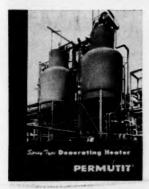
Wyandotte, Mich

Build your FLUIDICS* library



Automatic valveless gravity filter: Costs up to 45% less than conventional filters. Also saves money after installation, because it operates automatically without a single valve, agitator, pump, flow controller, or even an attendant operator. Bulletin 4351.

Permutit® Precipitator: Saves about 50% in ground space, 50%-75% in time of treatment, and 10%-40% in certain chemicals and adsorbents, compared to conventional reaction and settling tank. Complete facts on operation and application. Bulletin 2204C.



Deaerating Heaters: Designed for removal of carbon dioxide and oxygen from boiler feedwater. Permutit offers both Spray Deaerators, Bulletin 2357 and Tray Deaerators, Bulletin 4732.

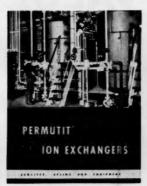
Water treatment chemicals: Permutit offers an extensive line of specialized chemicals. Typical data available: Bulletin CS-105 on Wisprofloc-20 Coagulant Aid, Bulletin CS-111 on Neutralizing Amines, Bulletin CS-110 on the Permutit Briquet System.



Standard packaged demineralizers: Factory-assembled, systems ready to connect and operate. For summary of applications, plus data on mixedbed, two-step, non-regenerable and skid-mounted units, send for Bulletin 4721.



High-capacity water softening: New Permutit® Model BD Softeners answer need for more soft water at lower cost. Details on operation, specifications and performance are in Bulletin 4696. Industrial water softening with Permutit automatic equipment, Multi-port Valve,® cation exchange, (zeolite) sodium cycle, systems and operation is described in **Bulletin 2386**.



lon exchangers: From Permutit-the only company to manufacture ion exchange resins and the equipment in which they are used-you can get a brief manual on use of ion exchange as a unit process for purification, recovery, addition, separation, concentra-tion. Bulletin 2508 covers Permutit resins and equipment.



How FLUIDICS works for you: Buyer's Guide surveys equipment for water and waste treatment, ion exchange, gas analysis, metering and control. Also equipment for handling corrosives, heat transfer, reactions, centrifuging and packaging. Send for Bulletin 992. problems involving fluids.



"New" metals for processing: Tantalum, titanium and zirconium are finding increased use, because of their exceptional corrosion resistance and strength. Corrosion, heat transfer and general application data on these metals, plus equipment available, are discussed in Bulletin 978.



Treating industrial wastes: Bulletin 4486 discusses types of industrial waste problems, equipment used, typical waste treatment systems.

*FLUIDICS is the Pfaudler Permutit program that integrates knowledge, equipment and experience in solving

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PFAUDLER PERMUTIT INC.

Permutit Div., Dept. CE-41, 50 W. 44th Street, New York 36, N. Y.

Please send me the following bulletins:

4696 Permutit BD Model Softener 2386 Zeolite Water Softeners

4721 Permutit Packaged Demineralizers
4351 Permutit Automatic Valveless Gravity Filter

2508 Permutit Ion Exchangers

2204C Permutit® Precipitator

CS-105 Permutit Wisprofloc-20 Coagulant Aid

CS-111 Permutit Neutralizing Amines CS-110 Permutit Briquet System

978 Process Equipment by Pfaudler 992 FLUIDICS Buyer's Guide

4486 Equipment for Treating Industrial Wastes

2357 Permutit Spray Deaerators

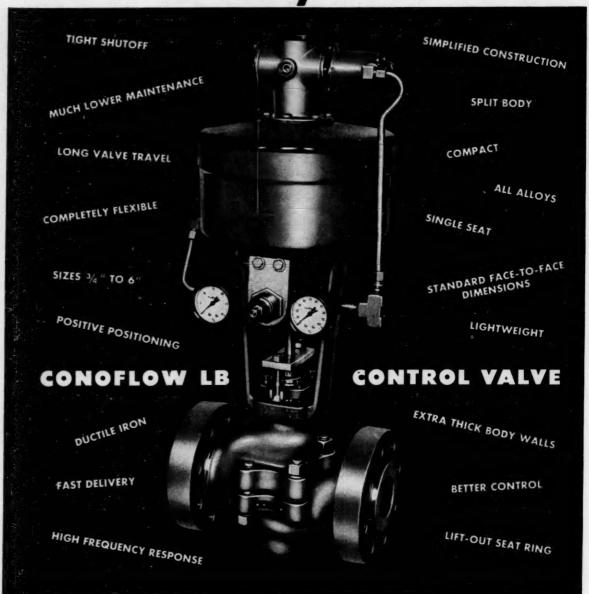
☐ 4732 Permutit Tray Deaerators

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When the job for gaskets calls for exposure to harsh chemicals and temperatures ranging from -100° to +600°F., you need a material that can take punishment in its stride. Du Pont's Armalon* TFE fluorocarbon resinimpregnated felt gives gaskets extended life under extreme operating conditions.

It resists attack by strong acids... conforms to uneven flanges... provides secure sealing at minimum pressures... has high anti-stick properties and low coefficient of friction.

Gaskets of "Armalon" last up to 700% longer than those of ordinary materials . . . cut replacement costs. They resist 99.3% sulfuric acid at 200° C. and often remain in service for a year and a half . . . reduce down-time. Stainless-steel pipes with gaskets of "Armalon" have carried HNO₃ fumes at 170°C. with 97 psi for 7 months with no default in operation.

There are scores of examples showing how "Armalon" proves its performance record under the most exacting conditions. A booklet describing many of these will be sent on request. Mail coupon today.

*"Armalon" is Du Pont's registered trademark for its TFE fluorocarbon resinimpregnated felts.

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E. I. du Pont de Nemours & Co. (Inc.) Fabrics Division, Dept. CE-14, Wilmington 98, Delaware

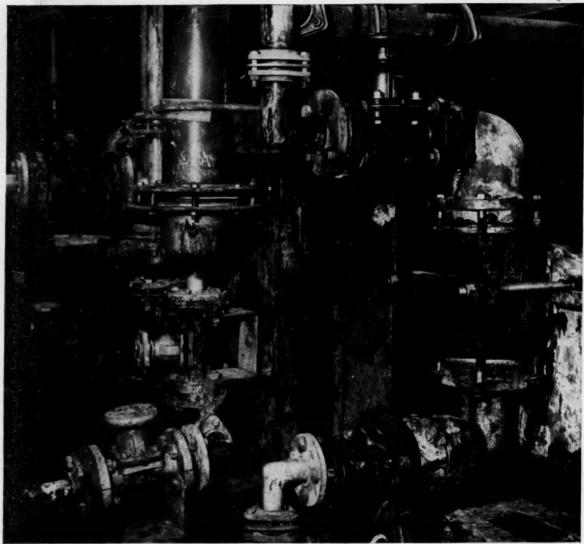
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Encrustation on two of the above valves was cleaned off to show lack of external corrosion. Compare this with the corroded condition of the structural steel.

Grinnell-Saunders Diaphragm Valves resist attack by hot corrosives at Carborundum Metals Company

During the past few years, Carborundum Metals Company, a Division of the Carborundum Company, has installed over 200 Grinnell-Saunders Diaphragm Valves at their Parkersburg plant in West Virginia. These valves were coated internally and externally with Penton *—and were equipped with fluorinated plastic diaphragms, backed with elastomer cushions. Their job: to handle highly corrosive caustic soda and sodium hypochlorite—at 212°F, and methyl isobutyl ketone, hydrochloric acid, sulphuric acid at 130°F—all used in processing zirconium ore for zirconium and its co-product, Hafnium.

Today, this manufacturer reports that after being in operation an average of two years, the rugged Grinnell-Saunders Diaphragm Valves are still giving good service. What's more, they've never had to replace parts in these Grinnell Valves!

In Grinnell-Saunders Valves, the diaphragm lifts high for streamline flow – seals *tight* for positive closure. Working mechanism is completely isolated from material in the line to prevent corrosion and contamination. There's a wide choice

of body, lining and diaphragm materials, too. See how Grinnell-Saunders Diaphragm Valves can help *your* installation.

Write Grinnell Company, Providence 1, Rhode Island.





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QUICK CHANGE ARTISTS

Fletcher-Matics—both Tornado-Matic and Suspend-O-Matic—are high capacity batch processing centrifuges. Once set for optimum cycling conditions—they give automatic, exact, repeat performances time after time. The exclusive Fletcher-Matic control system automatically starts, feeds, spins, rinses, brakes, unloads—then recycles—on a 24-hour basis if desired.

recycles—on a 24-hour basis, if desired.

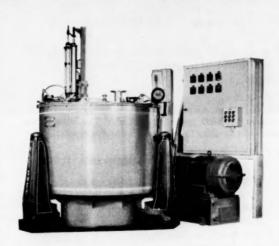
But—Fletcher-Matics are Quick Change Artists, too! When a process does require change—when a slight variation in RPM or the addition of a cycle phase is needed to improve the final product—Fletcher-Matics are quickly, easily adjusted externally—without need for shutdown. Without a stop—without a stammer, the Fletcher-Matic continues the cycling process—minicking immediately, precisely, and repeatedly the inserted changes.

Fletcher-Matics are available in many sizes. They're safetyengineered—any undue variation in speed, phase, or pressure triggers a "safety control center," brings the Fletcher-Matic to a prompt, safe, full stop.

Fletcher-Matics are practically self-operating. Controls and indicators are so simple there's no need for specially trained personnel.

Automatic . . . flexible . . . safe . . . stable—the Fletcher-Matic is a showcase of Sharples Centrifugal Skill at Work. See how the Tornado-Matic or Suspend-O-Matic fits into your operation. Write for Bulletin 202-560—Fletcher-Matic High Capacity Centrifuges.



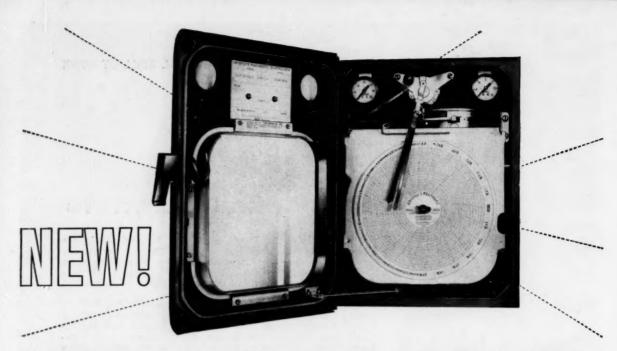


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Bristol Series 532 A/D*pneumatic <u>recording</u> controller is outstandingly SIMPLE, RELIABLE, and STABLE

- Simple modular design for ease of servicing
- High control stability for closer process control
- Designed for batch-type and continuous processes
- Proportional, proportional-plus-reset, and proportional-plus-derivative control models

Top control performance with maximum simplicity plus standard Bristol precision measuring elements—those are the key features of the Bristol Series 532 Recording Controller. The 532 uses the same renowned elements that have earned such a reputation for accuracy and dependability on other Bristol automatic controlling and recording instruments—perfected through wide experience and many years of development.

Self-contained modular design of the control unit speeds servicing. The whole modular unit, consisting of an aluminum casting with working parts made of stainless steel, Ni-Span C, and Neoprene diaphragms, can be removed by taking out only two screws and a link.

The die-cast aluminum instrument case ($15\frac{3}{4} \times 10\frac{3}{4} \times 5\frac{3}{4}$ overall) presents a streamlined appearance and is completely dustproof and weatherproof.

Write for complete data on the new, versatile, economical 532 A/D. The Bristol Company, 109 Bristol Road, Waterbury 20, Conn., a Subsidiary of American Chain & Cable Company, Inc.

ACCO

CONTROL UNIT CHARACTERISTICS:

PROPORTIONAL BAND: 0-400% continuously adjustable, direct- or reverse-acting.

RESET: 0.1 to 100 repeats per minute.

DERIVATIVE: 0 to 10 minutes derivative time.

AIR PILOT: Non-bleed type.

PILOT CAPACITY: Over 3.0 scfm.

FREQUENCY RESPONSE: Essentially flat to 300

cycles per minute.

TEMPERATURE STABILITY: Less than 0.1% change in the output pressure for 90°F temperature change.

CHART: 8" diameter; wide variety available.

MATERIAL: Aluminum housing; 316 stainless steel internal parts; Ni-Span C feedback element.

RECORDING' CONTROLLERS OFFERED FOR:

PRESSURE AND VACUUM: Ranges from full vacuum to 15,000 psi.

TEMPERATURE: Ranges from-100°F to +1000°F.

FLOW AND DIFFERENTIAL PRESSURE: With mercury-type manometer and dry-type differential unit.

LIQUID LEVEL: With bulb unit and mercury manometer and dry-type differential unit.

HUMIDITY: Zero to 100% relative humidity.

*Advanced Design

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Problem: Exhaust hoods that don't exhaust

This plant needs make-up air! If the exhaust hoods in your plant aren't doing their full job, chances are they are being outpulled by other fans. Other exhaust fans set up a vacuum by removing air faster than you replace it. Your plant needs make-up air ... a supply of new air to replace exhausted air.

Without sufficient make-up air, exhaust hoods can't do their job properly. Plant air becomes contaminated with fumes, dust, and odors. Workers' health suffers. Absenteeism rises; production lags. Other vacuum problems crop up: hot spots at inside areas, cold drafts along walls.

Solution: install a make-up air system -- fans to bring in outside air, and heaters to temper it. A make-up air system like this cancels out vacuum, gives balanced heat and ventilation.

For technical help on make-up air, see your Consulting Engineer. Or call in Sturtevant application : engineers. They're experts in handling air ... whether you want to move it, heat, cool or clean it. 4-80711

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A new casalog opens wide the doors to designers of process equipment — tells all you need to know in terms of engineering data performance charts, seals, metals, mountings!

If you need centrifugal pumps with these characteristics, this reference book is for you:

- PRESSURES: to 21 psi in single stage pumps; to 70 psi in multistage types.
- FLOWS: capacities to 70 gpm in single-stage pumps, to 10 gpm for multi-stage models.
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- DRIVES: Space-saving close coupled pumps most rugged and popular. Pedestal, mounted arrangement without motor available as alternate for belt or coupling drive.
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All to 3, 50 different models are described in full—and you get a wealth of technical data as well. Write for new catalog 130 now!



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How St. Regis Gets Closer Control Over Clay & Starch Mixes



DEFERIET, N.Y.—In preparing both clay and starch mixes, the St. Regis fine paper mill here controls solution strength with automatic meters. In clay, meters are used at three stages: Adding water to dry clay to make 55% slurry; cutting slurry to 15%; and proportioning slurry and water at the beater to dilute to 2%.

In starch, meters measure water into cooker for 20% mix, then measure both hot starch and water for accurate dilution 8%. Meters are Neptune Auto-Stop, 1 to 2 inches.

What works on starch and clay can also work for you. Write today.

Meter with a memory... Never forgets your formula



For liquid batching where formula repeats, this automatic meter has precise mechanical memory. Set quantity just once, open valve, and meter takes over. Shuts off at correct quantity batch after batch. Can even print tickets. Easy to reset for new formula. Ask for facts on Repeating Auto-Stop.

HOW TO STOP DRIP OF VISCOUS LIQUIDS. When metering viscous liquids, don't try to drain the line between meter and vat after each delivery. It'll drip forever, and you usually don't want air contact anyway. Instead, put an inexpensive spring-loaded Anti-Drip valve on the end of the pipe. Ask Neptune.

West Chemical Improves Accuracy With Stainless Steel Batching Meters

Operator merely pushes buttons; Auto-Switch shuts off pump at exact quantity

LONG ISLAND CITY—For safety, speed and accuracy, West Chemical Products, Inc., reports excellent results after replacing gauge-stick measurement with stainless steel liquid meters in formulating CN-Plus, Westpine, Tamed Iodine and other West sanitation products.



"Big savings are time and materials," says Rudolph Londner, plant superintendent. It took time to stop the agitators, wait for liquids to stop swirling, open the lids, and read the gauge sticks. And when batching errors showed up in the quality control lab, more time was wasted making adjustments and retesting.

Now accuracy is controlled by pushbutton. A row of buttons on each meter sets the quantity. A switch starts the pump. The meter keeps count and stops the pump automatically at the anticipated quantity.

Plouronics-Iodine Complexes

For ingredients such as plouronicsiodine complexes, West uses Neptune stainless steel Auto-Switch meters, which have only two moving elements in contact with liquid. For non-corrosive liquids, bronze Auto-Switch meters are used.

By assuring closer control, meters help comply with labeling regulations, and assist in obtaining government contracts. West also uses Neptune meters in ion-exchange and chlorination processes, and in the manufacture of waxes and soaps.

How can you benefit from West Chemical's experience? Neptune field engineers will be happy to offer helpful suggestions. Phone or write today.

HELPFUL METERING DATA AVAILABLE

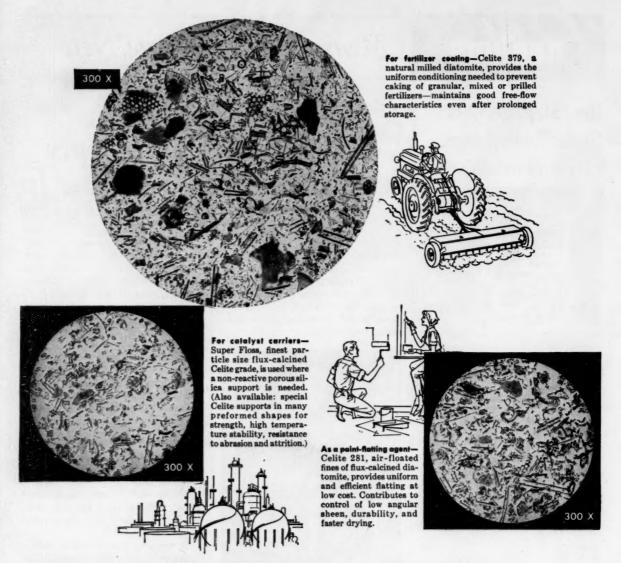
28-pg. technical bulletin lists liquids, helps pick proper sizes and features of meters 2 to 2000 gpm.

NEPTUNE METER COMPANY · Liquid Meter Division 47-25 34th St., Long Island City 1, N.Y.

Please send me helpful Meter Bulletin 566Q



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Celite diatomite absorbs its own weight of liquid...yet stays 'dry'

No matter which of the many available grades you choose, you can depend on a given volume of inert Celite* to retain its typical dry-powder characteristics even after absorbing its own weight of liquid.

Actually, Celite can absorb a total of more than twice its own weight. That's because a mass of the fine akeletal particles is approximately 93% air space or voids. Yet, in spite of this very high porosity, Celite is essentially non-hygroscopic.

Other unique properties—extremely high bulk, irregular particle shape and large available surface area—ideally suit Celite to hundreds of mineral filler applications. It is produced with precision from the world's purest commercially available dia-

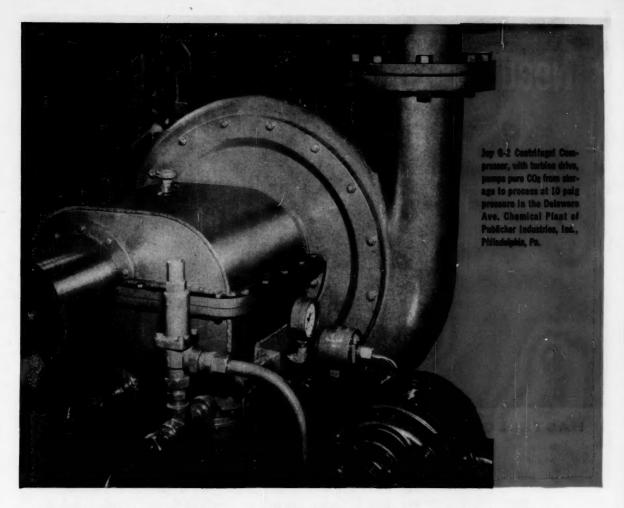
tomite deposit. It offers a wide choice of grades, each carefully controlled for complete uniformity.

For technical data on specific mineral filler or filtration problems, talk to your nearby Celite engineer. Or write to Johns-Manville, Box 14, New York 16, N. Y. In Canada, Port Credit, Ontario.

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Integral Gear Design of JOY Model G Centrifugal Compressors Saves Space—Gives Improved Reliability

The integral gear drive of Joy Model G Centrifugal Compressors, together with the highly efficient aerodynamic design, gives these machines twice the capacity of competitive units occupying the same floor space. High speed couplings are eliminated. Compressor and drive are mounted on a single base plate to further reduce the floor space requirement.

Joy Model G Centrifugals save you valuable floor space, and save you money by being "on the line" twenty-four hours a day—no costly process shutdowns. They are available in capacities from 500 to 15,000 cfm, for 4 to 20 psig duty on air service. Special seals and materials of construction can be provided to match any gas which you are handling. For full information on the Joy Model G Centrifugal, write for Bulletin 2564-11.

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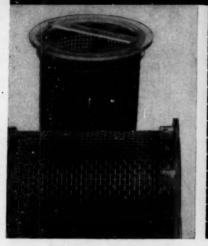




Joy Manufacturing Company Oliver Building, Pittsburgh 22, Pa.

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Refer to our technical data sheets in CHEMICAL ENGINEERING CATALOG, Page 185



The Cambridge Wire Cloth Co.

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INCOME QUOTIENT

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There certainly is no better tool in developing executive or management qualifications than through public speaking. Spoken words are a powerful tool of business. They are used to organize, motivate, coordinate, control, and train.

Since an executive must achieve results through people, he must be able to plan and organize. As a leader, he must be able to motivate and inspire people to action; he must make himself understood. He must have purpose and the will to make other people aid that purpose.

A speaker, too, achieves his results through people. He, too, must be able to plan and organize; must lead; must be able to motivate and inspire others to action; must make himself understood. The speaker must have a purpose and the will to make others aid that purpose. The skills of the executive are identical with those of a speaker, in these areas.

It is not surprising, then, that aspiring leaders in business and industry are judged by their associates and superiors, to a great extent, by their abilities to communicate. It is not surprising that an executive can sell himself, can attain greater authority by broadening his capacities for directing and leading, through oral communication.

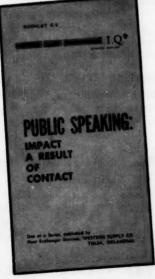
Words have great power, particularly the spoken word. Words give you contact with other men, and if you use them effectively, they give you — *impact*. That impact is multiplied as you develop your ability to speak, and as you speak to more important audiences.

If you are a novice in public speaking you are not alone. No more than 25 per cent of our speakers could qualify as "veterans."

Like conversation, speaking before an audience is based on sincerity and belief. It involves conviction and concern. The public speaker is most convincing when he is least artful, when he is most natural, and above all, when he is sincere.

Effective speaking is not an accident. It is not the special endowment of a few. While talking before many listeners may come naturally for a few, it is, by and large, a learned art. It consists of an idea, phrased simply, and delivered with conviction and with an expressive voice.

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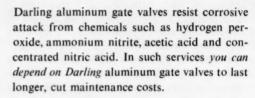


... the growth of engineering leadership in the process industry is of great importance to Western, because tomorrow's executives in the petroleum and chemical process fields are our prospective customers ... Experience in our own organization has taught us the impact of clear and forceful expression of original ideas and solutions to heat transfer problems, and we have thus recognized the importance of learning to speak to audiences of all sizes ... We've devoted another of Western's "professional development" booklets to this timely subject, and a copy awaits you without obligation ... Also without obligation, we offer our assistance in the solving of your next heat transfer problem.



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Darling aluminum gate valves are available in sizes from ½" through 24". We will be glad to make recommendations.

special engineering service. Darling engineers are ready to work with you in designing special valves to meet unusual service requirements. Write, wire or phone for prompt action.

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INSIDE:

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- 2. Handles 94% of Known Corrosive Solutions.
- Operating Temperature Range is: —65°to+300°F.
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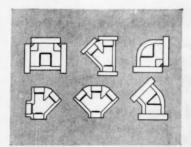


- 5. Combats Corrosive Environments.
- Effectively Stops Electrolytic Action.
- 7. Fibercast is Unaffected by Extremes of Heat or Cold.

How Fibercast pipe is better built to combat corrosion...inside and out!

Years of research and development have perfected the most versatile pipe tested for heat, pressure and corrosive applications. Years of actual field use prove its long service life! Here are the reasons why:

- FIBERCAST has a ceramic-smooth interior with a Hazen-Williams C Flow Factor of 147. Aids flow, resists deposit build-up.
- 2. FIBERCAST handles 94% of all known corrosive solutions. It is not impaired by acids, alkalies, salts, other damaging chemicals.
- FIBERCAST withstands any temperature range from -65° to +300°F.
 This is a wider operating temperature range than any nonmetallic pipe.
- FIBERCAST provides superior resistance to high pressures. Its operating range extends to 1200 psi.
- FIBERCAST has built-in inhibitors that combat the most highly corrosive environments and seals out contaminants.
- FIBERCAST provides resistance to high tension forces. It is inert stops electrochemical corrosion, forms an extremely durable dielectric shield.
- FIBERCAST is unaffected by summer heat or winter cold; has superior resistance to severe atmospheres and weathering.



Fibercast has the world's most complete stock of standard fittings, as well as couplings designed and made to order for individual requirements.

The effectiveness and long-term durability of Fibercast pipe are the result of built-in inhibitors—high tensile glass fibers, imbedded and bonded by heat in epoxy resin, and centrifugal casting. It gives Fibercast a high degree of smoothness, ruggedness, permanence—and superior resistance to exposures involved in the most difficult corrosive, pressure and temperature conditions.

Reliability with true economy is built in—inside and out—and throughout the inner core of the casing thickness. This unique combination of benefits is not found in any other kind of pipe: rubber, glass, plastic, steel, stainless, aluminum, asbestos, brass or copper tubing.



Fibercast Tubing (right) used to suspend a 1,200 lb. pump for 3 years in a salt water supply well. There was no loss in strength. The damaged plastic-coated steel nipple (left) was used in the same installation, failed after 3 months' service.

Fibercast is available for all lines from 2" tubing through 8" pipe for service from—65° to +300°F. For more information mail coupon.

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SUPER *66"

insulating cement

for temperatures up to 1800 F.



Because Super "66" Insulating Cement gives you less shrinkage (volumetric shrinkage wet to dry only 18½%), you get up to 20% greater dry coverage (50-55 bd. ft. per 100-lb.), with uniform thickness for better protection and strength. Result: You save warehouse space, time and labor costs.

Eagle-Picher Super "66" Insulating Cement sticks to hot or cold surfaces. It contains a special rust inhibitor that actually prevents corrosion. In addition Super "66" is easy to apply . . . reclaimable when used to 1200 F . . . and offers one of the most effective thermal barriers known. Super "66" can be applied on irregular shapes and usually requires no reinforcing on applications up to $1\frac{1}{2}$ inches thick.

Eagle-Picher produces a line of industrial insulations for all temperatures from below zero to over 2000 F. See our complete catalog in Sweet's Plant Engineering File or write for descriptive material.

Since 1843



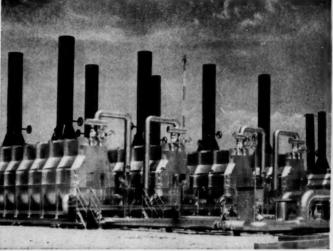
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100,000 to 200,000,000 BTU

PETROCHEM VERTICAL AND HORIZONTAL DIRECT FIRED HEATERS For the petroleum, chemical and petrochemical industries, Yuba now offers the most complete series of direct-fired heaters available. From 100,000 to 200,000,000 BTU per hour-from -200° to +2,000° F-Petrochem Vertical and Horizontal Heaters can be built in every size and type for every use in any location!

Yuba Heaters are available from the most simple horizontal design to the famous Petrochem vertical with optional reradiation cones for even heat distribution and maximum efficiency.

Working closely with both customer and prime contractor, Yuba can provide single piece, shop-assembled horizontal heaters to 30,000,000 BTU. Other heaters up to 50,000,000 BTU can be provided in two sections. For field installations of larger heaters, Yuba can provide well-trained supervisory personnel when desired. Get the complete story on Petrochem direct-fired heaters from Yuba – your largest single, fully-integrated source of supply.

Other Yuba Products For The Petroleum, Chemical and Petrochemical Industries—Adsco Expansion Joints, Transaire Air-Cooled Heat Exchangers, Shell and Tube Heat Exchangers, Southwest Floating Roof Tanks, Cone Roof Tanks, Pressure Vessels, Field Erection, Columns and Towers, Process Condensers, Custom Fabrication.



specialists in process heaters-every size, capacity and duty

YUBA HEAT TRANSFER DIVISION

YUBA CONSOLIDATED INDUSTRIES, INC.

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Utilizes Westinghouse silicon high-voltage rectifier cells



You get more power...reduce maintenance...increase reliability when you convert to Buell Silicon Rectifier Units Buell Silicon Rectifier Units Can Increase efficiency of your rec-

tifiers 25% or more # Perfected and specifically designed for fast, simplified conversion of existing mechanical or tube rectifiers They cut operating costs, reduce overall maintenance Enable more efficient utilization of power Eliminate rectifier maintenance Reduce outages Reclaim plant space - Suitable for indoor or outdoor installation For only a small investment you can materially improve your rectifier performance For details of the unit and a specific proposal write: Buell Engineering Co., Dept. 12-D, 123 William Street, New York 38 M Northern Blower Division, 6411 Barberton Ave., Clevefand. Ohio CYCLONES, ELECTRIC PRECIPITATORS, BAG COLLECTORS, COM-BINATION SYSTEMS, CLASSIFIERS, FANS.

W-K-M's ACF Ball

LEAKPROOF AFTER 600,000 CYCLES!



Proved in the laboratory, and in over five years of field service with such difficult ladings as acetone, propane, vinyl chloride, and lime and soda-ash slurry, W-K-M's ACF Ball Valve has earned a reputation for extra long life without lubrication. For example -

In one test, W-K-M opened and closed a 2" standard production model under pressure 600,000 times. The valve still sealed tight, and there was no measurable wear on either the chrome-plated ball or the Teflon seats!

W-K-M's rugged ACF Ball Valves are available in carbon steel to ASA 300 lbs. (some sizes 600 lbs.), and in semi-steel, ASA 200 and 400 lbs. WOG. Write for Catalog 1000.

Conduit is full-bore; Teflon stem gaskets and seats are sealed from the lading flow.

WHEN SO MUCH DEPENDS ON A **VALVE...SPECIFY ACF BALL VALVES**



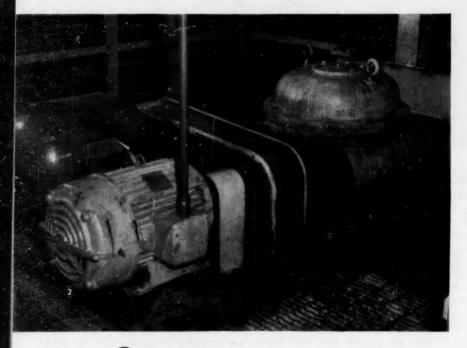
DIVISION OF OCT INDUSTRIES

P. O. BOX 2117, HOUSTON, TEXAS

6006



- 1. Union Starch & Refining Co., Granite City, III.
- Nettco Tank Top Agitator with two 25 hp motors, one operating — one as spare.





ADD STARCH AND STIR... UNION'S BIG RECIPE PAYS OFF!

Nettco Solves Suspension Problem for Union Starch and Refining Co.

PROBLEM:

Keeping a huge tank inventory of 192,000 gallons of starch liquor in constant suspension to satisfy a continuous demand 24 hours per day, 7 days per week.

SOLUTION:

Nettco engineers working closely with B. J. Hunter, director of manufacturing, determined the exact agitation requirement to maintain contents in uniform suspension at minimum cost. By drawing on years of specialized agitation experience, Nettco was able to utilize one of its standard tank top units — a 40 foot shaft, precision engineered to eliminate whip — and the right type and size of impeller for minimum horsepower.

RESULT:

Rugged, dependable agitation at low initial and operating cost. Repayment of original investment in tank and agitator in one year.

Try the pay-off combination of Nettco standard components, engineering and imagination on your next mixing job.

See Chemical Engineering Catalog for nearest representative or request Bulletin 581, Nettco Corporation, 87 Tileston St., Everett 49, Mass.



from Yarnall-Waring Company, Philadelphia 18, Pa.

BRANCH OFFICES IN 19 UNITED STATES CITIES • SALES REPRESENTATIVES THROUGHOUT THE WORLD STEAM TRAPS STOCKED AND SOLD BY 270 LOCAL INDUSTRIAL DISTRIBUTORS

3 REASONS WHY NEW YARWAY SERIES 130



IMPULSE STEAM TRAP SCORES BIG SUCCESS

This new Yarway all-in-one combination steam trap, strainer and blow-down valve—designed especially for moderate condensate load applications—is winning enthusiastic approval from users everywhere. Here's why:

it saves space

Entire trapping hook-up can fit into an area no larger than a "T" fitting. Straight-through piping, cleaner installations, more accessibility.

it saves money

Only one unit to buy—plus much lower installation and maintenance costs—results in large savings over conventional trap installations. A fair estimate—UP TO 30% IN TIME AND MATERIALS!

it saves work

No more installation headaches. As easy and quick to install as a pipe fitting. Maintenance is a breeze. Blowdown valve is operated by simple Allen wrench.

SERIES 130 traps are good for all pressures 8 to 600 psi, stainless steel throughout, have replaceable trap valve and seat, woven stainless steel strainer.

Why not try this compact combination on a steam main drip, tracer line or other moderate load application in *your* plant? Your nearby Yarway distributor can now supply you. For more details on Yarway Series 130 traps, write for Bulletin T-1743B.

Yarway Series 130 Impulse Steam Trap draining drip on 700 ft. house heating line at Eddystone Station of Philadelphia Electric Co. Pressure 150 psi; temperature 385° F.

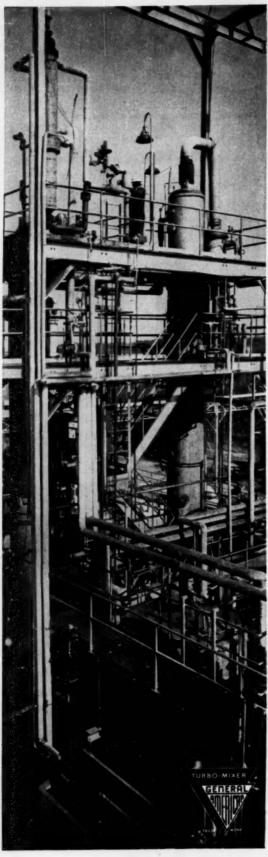


ANOTHER POPULAR YARWAY IMPULSE STEAM TRAP—SERIES 30

This is the "trap" part of the Series 130 described above—but without combined strainer and blow-down valve. Gives peak efficiency on moderate condensate load applications. Offers these features:

- Economy of operation, with close condensate control
- Long service life, with lever action reducing impact in valve seat
- Low maintenance; easily replaceable seat and disc
- High quality, all stainless steel—with a new low cost

Write for Yarway Bulletin T-1743.



TRY THIS SIMPLE **QUIZ ABOUT** THE RDC COLUMN

1. R.D.C. stands for

- a) Rapid Dispersion Column
- b) Recycle Displacement Column
- c) Rotating Disc Contactor

2. RDC Columns are made by

- a) 6 different manufacturers
- □ b) by one manufacturer
- c) by 10 manufacturers

3. The RDC column has been used for

- a) Separation of Hafnium from Zirconium
- □ b) Caustic extraction of acids from organics
- C) Caffein and vanillin extraction

4. The RDC column can be used for

- a) liquid-liquid extraction
- ☐ b) liquid-solid extraction
- c) liquid-slurry extraction

5. The RDC column has which of these advantages

- a) High volumetric efficiency
- b) No interstage coalescing or external settling
- c) Low power requirements

Answers

- 1. (C) Rotating Disc Contactor.
- 2. (B) RDC columns are made for the process industries exclusively by General American, and on a non-exclusive basis for the petroleum industry.
- 3. (A), (B) and (C). For a complete list of typical systems in service, contact General American.
- 4. (A), (B) and (C) again. The RDC column is one of the most versatile tools available for extraction processing.
- 5. (We did it again-all three are correct).

If you'd like more information on the RDC column and

the many advantages it offers, send for Bulletin T-1159. You'll find it pays to plan with General American.

Process Equipment Division-Turbo-Mixers GENERAL AMERICAN TRANSPORTATION CORPORATION

135 South LaSalle Street . Chicago 3, Illinois Offices in principal cities



Versatile low-cost

FEDERATED ZINC DUST

Now being used as a reducing agent, precipitating agent, purifier, catalyst, polymerizing agent, and in rust-resistant paints, bleaches, pyrotechnics, soot-removal, pipe thread compounds, and Sherardizing, zinc dust often does a better job than other compounds at less cost. Federated Zinc Dust is 97% metallic zinc, with a 97% through 325 mesh screen fineness. Send for half-pint experimental lot, and call on Federated's research and engineering assistance. Write or call: Federated Metals Division, American Smelting and Refining Company, 120 Broadway, New York 5, N. Y. or your nearby Federated sales office.

AMERICAN SMELTING AND REFINING COMP

FEDERATED METALS DIVISION

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IN CANADA: Federated Metals Canada, Ltd. Toronto, Ont., 1110 Birchmount Rd., Scarborough, Phone: Plymouth 73246

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HOW HERCULES HELPS...



MARK UP A STRIKE—A "pocket hit" is a thrill for the bowler but the pins take a beating. That's one reason why AMF Pin-spotters protects its new "Chemweld" pins with a top coat based on Hercules® nitrocellulose. In actual usage these pins remain clean and require a minimum of maintenance. Rugged nitrocellulose-based protective coatings also find use in coating the alleys themselves—for a smooth, long-lasting surface.





NOURISH WESTERN CROPS-

UN-32*, Hercules high-analysis nitrogen fertilizer solution, contains 32 per cent nitrogen by weight. Manufactured in California, UN-32 can be shipped to customers rapidly by tank truck, tank car or in larger quantities, via barge. A nonpressure, non-flammable material, UN-32 can be applied to soil by conventional spraying equipment, or fed into irrigating systems, or applied from the air. *Hercules trademark

MAKE BETTER DOUGH-

NUTS—Starvis®, Hercules gelatinized wheat starch, increases the absorption properties of bakery mixes such as doughnut, cookie, and ice cream cone, to provide consistent quality from lot to lot. This versatile ingredient is also used in popover mixes to give high water content in the dough, and offers advantages in such other products as breading mixes and sausage binders.



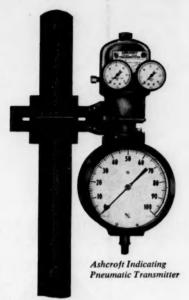
Hercules Tower, 910 Market Street, Wilmington 99, Delaware

CHEMICAL MATERIALS FOR INDUSTRY



signal

ASHCROFT PNEUMATIC TRANSMITTERS give you a true primary and transmitted signal for indication or control



action

Now-detect with precision accuracy the slightest change in primary pressure or temperature. Transmit this signal quickly to your indicators or controllers. Ashcroft Pneumatic Transmitters do the job at lowest initial and operating costs.

Full-range, solid-front indicating and totally accessible nonindicating transmitters need no costly high-pressure lines, yet permit complete monitoring of processes in remote areas. For safety's sake, you get full indication even if the air is shut off.

Narrow-span Ashcroft Transmitters are expressly designed with highest sensitivity and repeatability for the most accurate primary signal feed to controllers. You get better control and purer, lower-cost final products.

Only in Ashcroft Pneumatic Transmitters can you get the wide choice of Ashcroft Duragauge Bourdon tubes or American mercury or gasactuated sensing systems. You also get a time-proven, obstructionproof, force-balance, non-bleed replay for economical, maintenance-free 3-15 psi or 3-27 psi signal transmission. Both indicating and nonindicating suppressed types available.

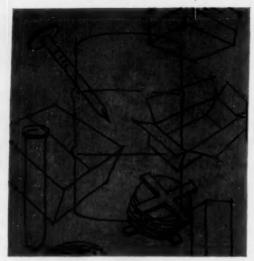
Write for factful Bulletins 360 and 361 or ask your nearby Ashcroft Distributor to help you select the right transmitters and receiver gauges.



ASHCROFT PNEUMATIC TRANSMITTERS A product of MANNING, MAXWELL & MOORE, INC.

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NOW! "CHECK WEIGHING" CAN BE MORE ACCURATE... MORE ECONOMICAL!



FAIRBANKS-MORSE BENCH AND PORTABLE "FLOAXIAL" DIAL SCALES



Now you can "check weigh" anything for industry (from a one-pound can to a one-ton barrel), in, out, or all about more accurately—more economically! Modern Fairbanks-Morse Dial Scales provide proved accuracy that works for you, year after year. And—because our Scales are built to last longer, you realize long-life economy . . . freedom from repairs or early replacements!

PROVED ACCURACY! Our "Floaxial" Dial Scales are famous for proved accuracy! Exclusive "Floaxial" mechanism eliminates knife edge or pin point pivots, features hard bronze fully adjustable cams, full-floating pendulums. Shielded ball bearings and corrosion resistant working parts assure free movement.

EASIER TO USE! Easy to use and move. Dial head swivels full 360° to any position. Rubber-tired wheels lock and/or Dial mechanism locks. Cast aluminum construction cuts weight.

EASY TO READ! Red knife blade indicator picks out just one scale graduation at a time. Special indicator

tip eliminates parallax. Black numerals on brushed aluminum dial. No paint to peel, crack, or craze.

LONG-LIFE SERVICE: Rugged lever systems take shocks of dropping loads and stay accurate! Pivots are hardened steel with precision ground knife edges.

CAPACITIES: BENCH AND PORTABLE DIAL SCALES: Available in capacities from 50-3200 lbs.

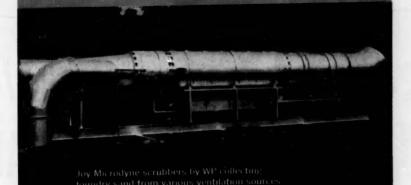
3 PLATFORM SIZES: 18" x 20", 21" x 29", 30" x 30" available for both Bench and Portable Dial Scales.

For further information, write: C. G. Gehringer; Scale Division; Fairbanks, Morse & Co.; 19-01 Route 208; Fair Lawn, New Jersey.

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A Pennsylvania foundry operator...
and a Montana rock grusher...agree:



When DUST is your problem-CLEAR IT WITH WP*

For an efficient, economical solution to any dust control problem—look to Western Precipitation. WP is uniquely fitted to handle your unique problem—being the one organization that custom designs, engineers and installs ALL types of dust and fume control equipment: Precipitator, Mechanical, Jet-Cleaned Filter, Hi-Temp Filter, scrubbers and engineered combinations.

With no axes to grind for any one system, WP engineers will give your job a completely unbiased recommendation—whether it's a quote on your specifications, a single component, or a completely engineered installation...small, major, simple, or complex.

An inquiry—on your business letterhead—will bring you literature promptly. Just write Western Precipitation, 1000 W. 9th St., Los Angeles 54, Calif. (In Canada, write 8285 Mountain Sights Ave., Montreal, P.Q.)

Dust and fume control since 1907

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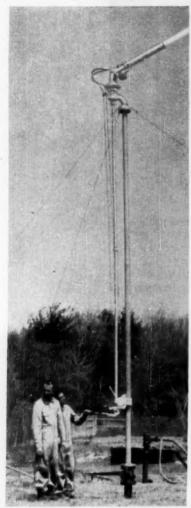
Division of Joy Manufacturing Company

ELECTROSTATIC Precipitators
MULTICLONE Collectors
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Fight fires from any angle... WITH ROCKWOOD SPECIALTY TURRET NOZZLES

Getting The Upper Hand...



Rockwood Extended Manual Control Turrets can be located 10 to 20 feet above a remote control station on the ground. Greater discharge range increases their fire fighting coverage. Higher extensions are engineered for special applications.

On the ground, on trucks, or towering over the flames, Rockwood Turret Nozzles are valuable fire fighting aids for use in refineries and chemical plants.

In fact, Rockwood makes the most complete line of specialty turret nozzles on the market. Every type is designed to fight fire four ways: with solid FOAM stream, FogFOAM, WaterFOG or solid water stream. And all are easily adjustable to meet changing fire conditions.

Throughout the country these Rockwood advancements are proving they can hit fires harder and faster. Find out how well they can protect your own plant. For an illustrated booklet on this complete line, write to Rockwood Sprinkler Company, Portable Fire Protection Department, 530A Harlow St., Worcester 5, Mass.

ROCKWOOD SPRINKLER COMPANY

A Division of The Gamewell Company A Subsidiary of E. W. Bliss Company

Engineers Water
... to cut fire losses

Distributors in all principal cities

Fighting Fires Four Ways



Rockwood Direct Manual Control Turrets give fire fighters "on deck" control from their cab roofs.



A Remote Manual Control Turret is easily handled by a man in the driver's seat. Ideal for fast action.

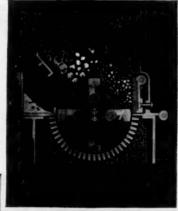


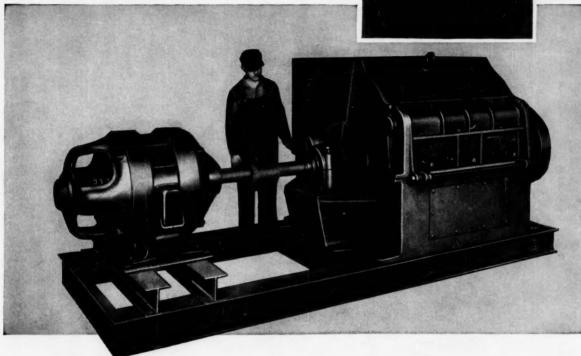
The Remote Hydraulic Control Type, single or dual model, is power controlled from within the cab. Widely used on crash rescue trucks,



The Portable Type goes off the truck and into action in seconds – wherever hose lines can be brought into action.

Complete size reduction...
from start to finished product...
in a single Williams Hammer Mill





Cut costs as much as 50% on production...up to 75% on equipment

WILLIAMS BUILDS THE BEST



In all normal crushing operations, a Williams heavy duty hammer mill can take most material and, in a single pass, reduce it to finished size! Production economies alone, in labor, power, maintenance, as well as stepped up output of better quality and more uniform products, will cut costs up to 50%.

Savings in original installations, as high as 75%, can also be expected. By making primary and secondary crushers unnecessary, a Williams hammer mill will eliminate all extra con-

veyors, drives, other equipment, special foundations and additional housing.

Williams hammer mills are built for daily rough and rugged service. Extra heavy manganese steel liners and breaker plates, oversize shafts, massive parts and reinforcements, all defy shock and wear, reduce downtime and replacements to nil.

If the cost price squeeze is one of your problems, get the facts about Williams hammer mills. Write now for catalog.

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PATENT CRUSHER & PULVERIZER CO

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Oldest and Largest Manufacturers of Hammer Mills in the World



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Every major filter press manufacturer in America recommends Eaton-Dikeman filter papers.

NEW SYNTHETIC PAPER — Eaton-Dikeman is producing a 100% Dacron paper which is made by the new Du Pont textryl technique. It is very strong, is chemical and heat resistant, and picks up very little moisture. Samples of several weights are available for filtration as well as other uses in the chemical industries. Paper of Orlon and Nylon can also be made by the same technique. Write today.



"Tell us, Mr. Schwarting..."

How well does J&L Electricweld basic oxygen steel heat exchanger tubing perform day after day on the job?

This is an important question. There are 23 miles of heat exchanger tubing in the giant soda ash plant of Solvay Process Division, Allied Chemical Corporation, in Syracuse, N.Y.

Let one of Solvay's top chemical engineers, Nathan Schwarting, answer the question:

"J&L Electricweld basic oxygen steel tubing gives us superior corrosion resistance...

"Electricweld basic oxygen tubing is easy to install, easy to weld and form...

"The temperature shocks that make some steels separate and pull apart do not seem to affect J&L tubing...

"The uniformly high quality of J&L pressure tubing insures against blisters, or pitting, that form around surface imperfections in tubing...

"It's apparent that all along the line there are I&L workmen who take pains with what they do..."

Experiences of Solvay Process engineers show that J&L Electricweld pressure tubing, made from basic oxygen process steel, has longer life than common materials.

Perhaps J&L open hearth aluminum-killed special soundness quality steel or basic oxygen steel pressure tubing can help you solve heat exchanger or condenser maintenance problems, too. Your J&L sales representative is ready to help—or you can write direct to J&L.

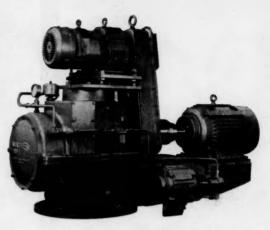
Jones & Laughlin Steel Corporation ELECTRICWELD TUBE DIVISION 3 Gateway Center · Pittsburgh 30, Pennsylvania



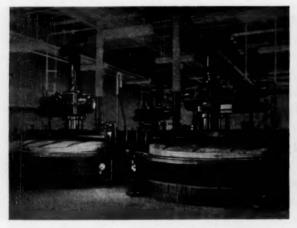


YOUR MIXING REQUIREMENTS SPECIAL?

Look at these four examples of the way Philadelphia Mixers can be engineered to meet special process needs.



Two output speeds—12½, 16½, 23 and 32 rpm meets varying process needs of different grades of raw materials.



Impeller raising and lowering devices provide optimum mixer performance continuously while impeller position is changed with application of full drive torque.



Variable speed, remote-controlled drives permit changes to be made in mixer operation to meet varying process requirements.



Four-speed mixer drive $-4\frac{1}{2}$ and 68 rpm—meet requirements for extremes in mixing speeds.

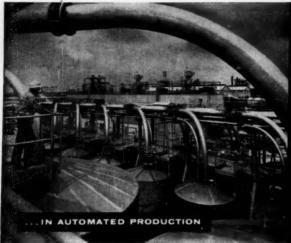
A specially engineered mixer drive may be the answer to your processing problems. Our experience in this area is extensive, and our engineers will be glad to work with you. Send us the details. If you also want information on our complete standard line, write on your company letterhead for mixer catalog A-19.

philadelphia mixers

PHILADELPHIA GEAR CORPORATION

King of Prussia (Suburban Philadelphia), Pennsylvania



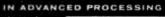


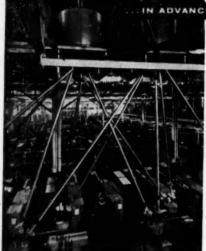
Airstream Conveyor Systems automatically handle polyethylene throughout all phases of production — drying, extruding, pelletizing, storage and bagging — at Phillips Chemical Co., Pasadena, Texas. High-volume, high-purity Dracco systems like this are used by most major plastics



Typical unloading-to-storage-to-process systems, like this one at St. Louis feed supplement plant of Merck & Co., enable bulk materials users to take best advantage of other modern production techniques and equipment. Such systems are easily expanded, with minimum engineering cost, when handling requirements increase.

Dracco experience gives you pneumatic conveying at its finest!

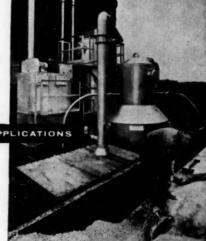




Automatic in-plant materials distribution with Airstream Conveyors enables Western Electric Co. to apply new cable insulating and sheathing methods at Point Breeze Works, Baltimore. Systems carry 11 different colors of polyethylene pellets over distances up to 700 feet, supplying 50 extruding machines without contamination or intermixing.

. IN SMALL-QUANTITY APPLICATION

Airstream Conveyors prove economical in handling quantities as small as one carload a month, or the equivalent. This low-cost, ground-level system at a mid-western processing plant is used only periodically to unload lime from trucks to storage, yet provides important savings in materials and labor costs.



Whether your dry materials handling requirements are large or small, simple or complex, it pays to install an air conveyor engineered by experienced specialists. To be sure you get the system best suited to your application, contact: Dracco Division of Fuller Co., Harvard Avenue and East 116th Street, Cleveland 5, Ohio.

DRACCO

airstream conveyors
dust control equipment







What the affiliation of Rochester Manufacturing Co. with American-Standard® means to you

Perhaps you read the story in the Wall Street Journal. "American Radiator and Standard Sanitary Corp.... has acquired Rochester Manufacturing Co., maker of gauges and instruments. Rochester Manufacturing will operate as a part of American-Standard Controls Division."

There was more. But what is of immediate concern to you is: what does this consolidation of two great names in the field of instrumentation mean to the petroleum and chemical industries?

It means expansion of Rochester Instruments' research and development program, reflecting broader product lines.

It means that the scope of the Rochester operation will be increased to serve industry more effectively.

It means that the complete facilities and capabilities of the American-Standard Controls Division are at your disposal as Rochester engineers work with you.

In short, it means growth... greater resources and development of important new products to take their place beside Rochester thermometers and pressure gauges—and Detroit Pressure and Temperature controls, Norwood Electrosyn systems and Strain Gauge Pressure Pickup.

We look forward to the opportunity, as we always have, to help you keep pace with America's growth and development, but now we meet the challenge with a greater abundance of resources.

The familiar RMC trademark, symbol of quality instrumentation, has undergone a design change as a result of the affiliation of Rochester Manufacturing Co. with American-Standard. Here (right) is the new trademark for Rochester Instruments, and this is our new name: American-Standard Controls Division, Rochester Instrument Plant, 113 Rockwood Street, Rochester 10, New York.





Rochester Thermometers



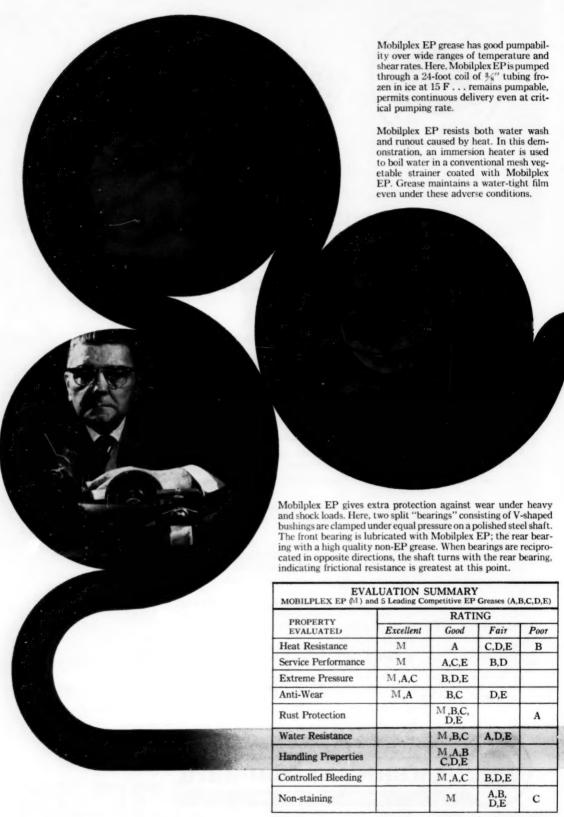
Rochester Pressure Gauges



NORWOOD Strain Gauge Pressure Pickup (to 100,000 psi.)



DETROIT Pressure Control Switch



The Multi-Service* Grease with unique Calcium EP Complex. Never before in a single lubricant such a wide range of use... such a margin of superiority... such a potential for maintenance savings!

Versatility unparalleled...

Mobilplex

A product of Mobil research . . . Mobilplex EP . . . a Multi-Service extreme-pressure grease far superior in quality and range ${\cal P}$

of applications to any multi-purpose grease available.

Mobilplex EP, with a unique Calcium EP Complex, provides maximum protection against wear, rust, washout and heat. Because of its greater versatility, Mobilplex EP goes further than competitive extreme-pressure greases in simplifying your lubricant application, storage and purchasing practices. This new-type lubricant has given industrial machines greater protection while replacing as many as seven other greases. Mobilplex EP has all of the advantages usually associated with EP greases—as well as excellent storage, structural and oxidation stability.

Examination of the Socony Mobil evaluation summary at left shows that in comparison with five competitive extreme-pressure lubricants Mobilplex EP is the only grease excellent or good in every grease quality tested. No wonder aluminum and steel mills, metalworking shops, cement plants, and the chemical and rubber industries are reporting dramatic success with Mobilplex EP.

For full details contact your local Mobil representative, or write Mobil Oil Company, 150 East 42nd Street, New York 17, New York.

*Multi-Service means excellent for all types of anti-friction and plain bearings under various operating conditions up to temperatures in the range of 300 F. and for all types of dispensing equipment.



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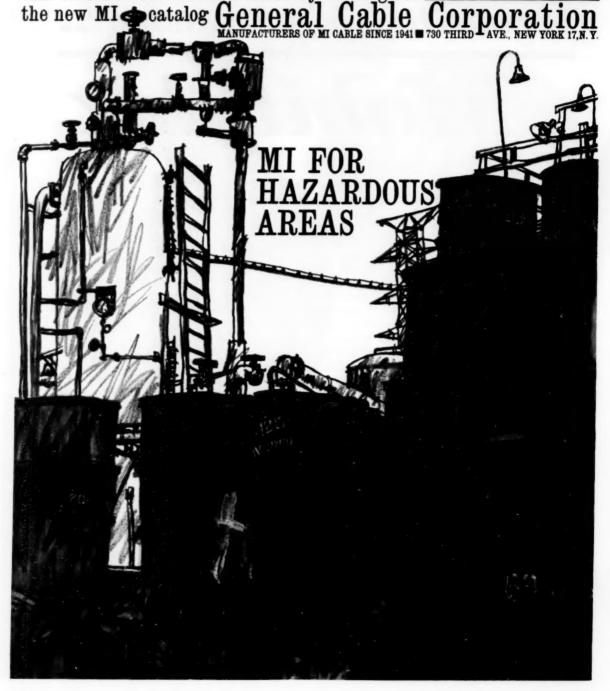
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News from

National Carbon Company

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National Carbon Design Engineers multiply your engineering staff



C. E. HULSWITT Design Engineer

Mr. Hulswitt, since becoming associated with National Carbon Company in 1956, has been instrumental in the design and development of an extensive variety of "Karbate" impervious graphite chemical process equipments.

One of the design areas in which Mr. Hulswitt has been particularly active is that of hydrogen chloride combustion, absorption, and stripping.

Mr. Hulswitt was graduated from Purdue University with a B.S. degree in Chemical Engineering.

New Catalog Section Describes "Karbate" Counterflow Block Heat Exchanger

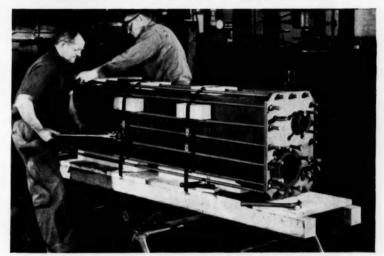
A detailed description of "Karbate" impervious graphite heat exchangers Type CFB is presented in a new, 8-page Catalog Section—S-6813.

Information on this new, advanced-design, corrosion-resistant unit includes operating features, specification data on single and multi-pass models, construction and dimensional data, fluid flow patterns, pressure drop characteristics, and mounting methods. The catalog is fully illustrated with photographs, diagrams, and graphs.

Utilizing center blocks of impervious graphite, "Karbate" heat exchangers Type CFB provide the most versatile and dependable method of processing corrosive materials.

Write today for your copy of this timely, comprehensive publication. Ask for Catalog Section S-6813.

New "KARBATE" Condenser Type CFB on Way to Handle a Highly Corrosive Application



This new single-pass, three-pass unit is being prepared for shipment to a Midwestern chemical company for condensing an organic from an acid steam distillation operation. Fluids on both sides of 90 square feet of heat transfer surface contact "Karbate" impervious graphite only.

"Karbate" impervious graphite Type CFB is the newest cost-saving advancement in heat exchangers.

Measuring only 13 inches x 21 inches in cross-section, Type CFB (when mounted vertically) provides more heat transfer area per square foot of floor space than any other block type exchanger.

In addition to the unsurpassed corrosion resistance of "Karbate"

impervious graphite and the high thermal efficiency of true counterflow design, Type CFB permits maximum flexibility in change of heat transfer area. Center blocks, each 23 inches long, can be varied from 1 to 6 to provide a range of areas (for 3-pass unit) from 37.3 to 172.8 square feet. Single or multi-pass units give dependable operation at pressures up to 100 psi.

Other "Karbate" Equipment for Chemical Processing Systems

For incorporation in systems for the external heating or cooling of corrosive solutions used in plating, pickling, anodizing, and cleaning, "Karbate" impervious graphite is available in products and equipment such as: Pipe, fittings, and

valves . . . for long life, easy installation, minimum maintenance.

Centrifugal pumps ... frame-mounted and motor-mounted ... available in 22 models serving a wide capacity range.

models serving a wide capacity range.

Other major items of "Karbate" impervious graphite include: Shell and tube heat exchangers, HCl systems, absorbers, combustion chambers, entrainment separators, and cascade coolers.

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for performance only, rely on Aloyco Stainless Steel Valves

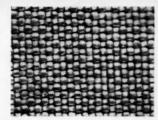
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wherever corrosion is a problem. Want a safe, economical way to handle corrosives? Write: Alloy Steel Products Co., Inc., 1301 West Elizabeth Ave., Linden, New Jersey. 03

STEEL PRODUCTS



FILTER FABRIC QUIZ



1. This is a plain weave ... TRUE FALSE



2. This is a twill weave . . . TRUE FALSE



3. This is a satin weave . . . TRUE FALSE

1. TRUE. You can always identify a plain weave by its simple "one up and one down" construction. It permits maximum yarn interlacings per square inch and, in a tight weave, affords high impermeability and covering qualities. Used in cottons and synthetics.

2. FALSE. This is a satin weave. With fewer interlacings, spaced widely and regularly, a satin weave has increased porosity, smooth surface and high cover factor. It is valuable in gaseous filtration, such as dust collection. In cotton, commonly known as sateen.

3. FALSE. This is a twill weave—distinguishable by the sharp diagonal line. In equivalent constructions, twills have fewer interlacings than plain weaves—and greater porosity. Filter twills woven of both cotton and synthetic fibers are widely used.

Weave is a very important consideration in the selection of a filter fabric, but many other factors help determine a fabric's performance—fiber, count and finish, for example. That's why you need the assistance of a specialist—like the specialists who distribute

Wellington Sears filter fabrics. They're experts in the field—and always ready to lend a hand in helping solve your problems. For their names, and a free copy of our illustrated booklet, "Filter Fabric Facts," write Dept. L-4

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Chementator

Stereo rubber pace quickens; will it overtake SBR in market?

Developments in stereo rubber continue to unfold, keeping these materials in the forefront of today's news.

Goodrich-Gulf Chemical Corp. has licensed Polymer Corp., Shell Chemical, Ltd., of England and Chemische Werke Huels of Germany to manufacture cis-polybutadiene. Polymer's plant will be a 20,000 ton/yr. unit at Sarnia, Ont. due to go on steam late in 1962.

Through these arrangements, the licensees will gain access to the use of a cobalt catalyst system that produces 98% cis polymer, 4 to 13% higher than can be obtained with titanium catalyst. Vinyl content can be held under 1% whereas with the titanium system it is 2-3%. An even greater margin of superiority is claimed for cobalt over the lithium catalyst system used by others,

To date, only Phillips Petroleum is producing commercial quantities of polybutadiene, selling for $31.5 \ensuremath{\phi}/\text{lb}$. Eventually, the price is expected to come down to polyisoprene's $28.1 \ensuremath{\phi}/\text{lb}$., or below it

However, there is another dynamic factor in the price picture: product modification. Shell Chemical has put the first oil-extended polyisoprene on the market at 24.1¢/lb. Although Phillips is not yet producing an oil-extended polybutadiene, the company has a process all ready to go when demand develops.

For competition, these stereo-regular rubbers face straight SBR rubber, now selling for 24.1¢/lb., or an oil-extended modification at 18.85¢. But price alone will not determine the future of these new materials—predicted to hit a U. S. capacity of 200,000 tons/yr. by the end of 1962.

Spokesmen of Goodyear and Goodrich-Gulf view that future and its relation to SBR in this way:

"It would appear that SBR consumption in the U. S. will stay at a level of 900,000 to 950,000 tons because the natural increase in demand caused by industry growth is offset by the advent of the stereo rubbers in the market."

"Outstanding test results on truck-tire treads fabricated from polybutadine suggest that this new polymer not only will compete qualitatively with natural rubber in such applications but eventually may replace, at least in part, SBR now being used in passenger-tire treads."

New glycerin process is first to use carbohydrate feed

Commercial glycerin—up until now either a soap byproduct or a petrochemical—is about to acquire a third raw-material base from the area of chemurgy.

Atlas Powder Co. plans to produce 50 million lb. of glycerin and related polyols from molasses by a company-developed process involving both hydrogenation and hydrogenolysis of carbohydrate raw materials. A \$17 million plant will be completed near Wilmington, Del., during the second quarter of 1962.

Product will be sold at competitive prices. But in order to make the project economically attractive, Atlas had to circumvent pitfalls that deterred others—such as Du Pont, Commercial Solvents, the old I. G. Farben—who researched similar routes.

Raw-material supply had to be free of the severe price fluctuations attending such low-grade agricultural byproducts as blackstrap molasses, yet somewhat below the price of products qualifying under the U. S. sugar quota. Feed for the hydrogenation had to be pure enough not to poison the catalyst. All three needs were satisfied by arranging long-term contracts with sugar refiners for the purchase of invert molasses, a refining byproduct that has been purified somewhat by desiccation, concentration and hydrolysis (inversion) of the sucrose content.

Atlas declines to discuss process details but a low-temperature reduction step converts the feed to sorbitol and some mannitol. A second—



Why, indeed? As long as you're in a hydrogen area, there's just as much danger of explosion with one piece of equipment as there is with the other,

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Crouse-Hinds is the only single source for complete systems of UL-listed explosion-proof electrical equipment, no matter what the National Electrical Code Class or Group.

Crouse-Hinds is also your prime source for expert assistance in choosing and applying equipment for hazardous areas. A Crouse-Hinds Field Engineer is always available to help you plan complete protection in flammable atmospheres of gases, vapors or dusts.

Call your Crouse-Hinds Distributor while you're still in the planning stage of building or remodeling. That's the time he can really save you money!

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this time, high-temperature—reduction step aims at splitting sorbitol to give two glycerin molecules. Past researchers were often plagued with a useless mixture of polyols from this step. But Atlas gets a satisfactory glycerin yield and is able to separate it.

Some of the glycerin will be used captively for explosives and other Atlas products; most is already contracted for by outside customers.

Isolation of action-centers leads to higher activity for new enzymes

Deviating from the general belief that enzymes consist of large protein molecules with catalytic power localized in small action centers, biochemist Toyosaku Minagawa and his associate Takashi Hamaishi of Tokyo's Nippon Compost Laboratory have recently introduced some rather unorthodox concepts regarding the nature of enzymes.

According to Minagawa, an enzyme is not necessarily a protein but can be considered as a special metal chelate compound; therefore, if the enzyme is handled as such, its activity can be controlled by cations or anions.

Pacific Laboratories in Hawaii has capitalized on this theory by developing a new process for making hydrolytic enzymes. Deemphasizing the large and "useless" protein portion of enzyme molecules, PL has apparently succeeded in isolating the portion that contains the action centers. Resulting enzymes carry very high catalytic activity per unit weight.

Minagawa's work indicates that controlled enzymes are highly effective for pulping bagasse, processing silk fiber and de-inking waste newsprint. Pacific Laboratories' marketer, Western Biochemical, San Francisco, looks for them to find use in the preparation of coatings, adhesives, foods and detergents.

Interest mounts on how to make and use submicron particles

A whole new area of technology is developing relative to ultrafine particles—below 1 micron. Over a dozen papers dealing with production, properties and particle-size measurements of materials in this range will be presented at the Electrothermics and Metallurgy Symposium of

the Electrochemical Society in May held at Indianapolis.

Among the methods now available for making the fine powders (smaller than 1 micron in size) are decomposition of metal salts in a flame, evaporation of metals in an inert gas, chemical precipitation, jet pulverization, and vaporization in an electric arc. Many of the particles thus produced range from 100 to 1,000 A. Powder metallurgy techniques were originally designed for powders not much smaller than 1 micron.

New applications for the ultrafine powders are being actively sought by a number of companies. Some of the more promising uses are for extremely thin films of insulation on miniature electronic components; for catalysts with very high surface/volume ratios; as additives to solid rocket fuels; and for ferromagnetic work, where particles in the 100-150 A. range approach the size of the magnetic domain.

Ultrafine particles are also being used in powder metallurgy in hot pressing, cold sintering, dispersion hardening, and in preparing ceramic forms—although for ceramics new techniques to avoid cracking are needed.

Lukens Steel's answer to the need for titanium cladding is a process that handles plates up to 96 x 288 in. at 1/4 to 11/4-in. thicknesses. Procedure requires low-alloy steel, containing Mo or Cr to slow the formation of intermetallic Ti-Fe compounds. Argon flushing creates inert atmosphere.

First tests bolster hope for fission route to hydrazine

Aerojet-General Nucleonics has taken a significant step toward full-scale use of its fissio-chemical route to inexpensive hydrazine, in which the product is formed from ammonia in an irradiated system containing uranium dioxide (*Chem. Eng.*, Sept. 5, 1960, p. 46).

Company has completed first-phase tests that were designed to learn basic characteristics of the ammonia-nitrogen-uranium dioxide reaction system, at the Livermore, Calif., Radiation Laboratories and reports highly satisfactory results. Test conclusions point to commercial-

(Continued on page 120)

AT LAKESIDE LABORATORIES, P-K VACUUM TUMBLE DRYER PRODUCT UNIFORMITY... LOWERS LABOR COSTS... REDUCES DRYING

Lakeside Laboratories, Inc., a Milwaukee manufacturer of ethical pharmaceuticals, has replaced conventional tray drying with a P-K Vacuum Tumble Dryer. The pre-packaged 20 cu.-ft., stainless steel unit arrived fully engineered, ready for start-up. "It had everything we wanted—a hot water jacket vacuum pump, condenser, condensate receiver, vacuum control valve, water heater and circulating pump—and was reasonable in cost," explains Joseph Jacques, plant engineer.

Today, all products Lakeside manufactures in quantity are processed in the P-K unit. "It has made it possible for us to reduce drying time as much as two-thirds and cut labor costs in half," says Mr. Jacques. "It used to take 48 hours to dry a batch of material we're now

able to prepare in 16 hours. Handling time is a fraction of what it was and the resultant blend is more uniform in texture and color. Furthermore, moisture content of products can be reduced to as low as 1/10 of 1% in the vacuum tumble dryer.

"Cleaning, too, is faster and easier, thus facilitating formulation change-over without time loss. After each use, the dryer is filled with water, rotated and flushed. There's never any residue and reduced handling also reduces chances for contamination."

ONLY P-K OFFERS COMPLETELY PRE-PACKAGED

VACUUM TUMBLE DRYERS Packaged vacuum tumble drying equipment—tailored to individual requirements



and thoroughly proved in performance—is available only from Patterson-Kelley. It is delivered compactly as embled, fully balanced and ready for use. Yet, costs are far less than user-assembled units. In addition, it provides a single source of responsibility. In every step from design through start-up, it saves time—eliminates trial and error expense.

PRE-TEST BEFORE YOU BUY Visit the P-K PRE-TEST LABORATORY for a preview of the economies *you* can realize with a packaged vacuum tumble dryer. P-K engineers have run thousands of resultful pre-tests for processors. They justify investment, provide accurate scale-up data and operational procedures. Production

models of standard, intensifier and liquid-solids Twin-Shell[®] blenders are available, as well as packaged vacuum tumble dryers. Our new P-K Solids Processor that telescopes up to ten operations in a single unit is also featured in the Pre-test Laboratory.

Send us your materials, if you can't come in person. To make arrangements, write or call George Sweitzer at East Stroudsburg. Dial 717—Hamilton 1-7500.

Our new Solids-Process Catalog #16-P contains complete technical information on P-K equipment. We'll gladly send you a copy.



Chemical and Process Equipment Division 124 Burson St., East Stroudsburg, Pa. scale production costs of $40 \/e/lb$. or lower—and AGN feels that this figure might go down to $10\text{-}15 \/e/lb$. if geometry of the system is improved. Current price that the Air Force pays for rocket hydrazine has not been divulged but unofficial estimates have placed it as being much higher than AGN's range.

The experimental setup at Livermore consisted of a metal capsule, containing a suspension of uranium dioxide in anhydrous liquid ammonia, that was exposed to a measured neutron flux in a nuclear reactor. Program focused attention on the actual formation of hydrazine, with less emphasis given to downstream separation and purification aspects. Yield figures were equivalent to 0.029—0.058 lb. of product from the equivalent of 1 kwh. radiation.

Air Force has financed AGN's efforts to date, and the firm hopes to win a contract for continued work. Next step would be a continuous reaction loop, utilizing an external neutron source and a subcritical reactor, to pin down reaction parameters and tackle problems of product separation and purification. This phase, requiring some 30 mo., would be followed by a pilot plant, probably operated at an Air Force installation that included a self-sustaining reactor.

Solids pipelining wins new job, delivers concentrates to railroad

Taking advantage of sloping terrain that provides all-downhill travel, up to 1,000 tons/day of copper-concentrates make a pell-mell trip from concentrator to railroad at Anaconda's copper-producing facility in the Atacama Desert region of Chile.

Designed by Anaconda's subsidiary, Anaconda-Jurden Associates, Inc., the pipeline is the key to an over-all processing scheme, in which 1.5% Cu ore is concentrated near the mine, piped to the railroad, and carried an additional 40 mi. to the smelter. Without the pipeline, dewatered concentrates would have to be hauled down an expensive right-of-way consisting of a series of switchbacks.

In operation, ore from El Salvador mine is crushed and concentrated to form a pulp containing 30-45% Cu. Partially dewatered in thickeners to an average concentration of 45%, the pulp slurry flows into a 6-in. pipe for the gravity-powered trip to the railroad. The pulp,

containing 95% of particles smaller than 325 mesh, has a specific gravity of 1.6-1.7.

For the first 13 mi., the slurry flows at 6-7 ft./sec. down 3-4% grades. Then it passes into a 5-in. line for a precipitous 20-ft./sec. journey down a 20% slope to the railroad. Original design called for dewatering in holding tanks, but the slurry's settling rate proved so rapid that it is now fed directly into the cars; after 3-4 hr., the water is decanted and the concentrates are hauled about 40 mi. to the smelter at Patrerillos.

Miller Brewing Co. and Union Carbide Development Co. have collaborated on development of 4 to 1 beer concentrate that is biologically stable and easy to reconstitute at point of sale. Freezing-centrifuging process eliminates need to age beer.

Thermal diffusion separates superior lube oil fractions

Standard Oil of Ohio says that its thermal diffusion process can boost motor oils' operating life by 50%. At the St. Louis meeting of the American Chemical Society, Sohio's H. E. Alford commented further on the superior properties acquired from thermal diffusion concentration.

In fractionation of lubricating-oil stocks, thermal diffusion does the remarkable job of giving many fractions that are very similar in both molecular weight and volatility although widely different in their density, refractive index, viscosity and color. Sohio reports that lubricating oils produced in this fashion show a high resistance to air oxidation and won't thin out at high temperatures or thicken at low ones.

Company's process, an outgrowth of similar diffusion techniques first used to separate uranium isotopes during World War II, can efficiently separate hydrocarbons of all molecular weight ranges through asphalt.

Basic hardware is surprisingly simple: it consists primarily of two parallel surfaces in vertical position, the narrow space between them filled with the liquid to be processed. When one surface is heated and the other cooled, the temperature difference causes a concentration gra-

(Continued on page 122)



Here is a MACROPORT* "A" aluminum oxide sphere - Norton Company's newest development in catalyst carriers shown enlarged. Note its extremely porous structure, specifically designed to promote faster, more precisely controlled gaseous reactions. Pores are much larger than those in other Norton catalyst car-

riers, permitting gases to enter and diffuse readily, yet providing sufficient restriction for optimum control.

MACROPORT "A" catalyst carriers are currently available as spheres. pellets, and aggregate of fused aluminum oxide in the same price ranges as standard Norton carriers. A research program is now underway in the

Norton laboratories to develop MACROPORT carriers in other materials.

For better yields from your reactors and improved process economy, get complete details on Norton MACROPORT "A" carriers. Write NORTON COMPANY, Refractories Division, 503 New Bond Street, Worcester 6, Massachusetts.

TYPICAL PHYSICAL PROPERTIES

MACROPORT "A" Apparent Porosity % H₂O Absorption % App. Sp. Gravity g/cc Bulk Density g/cc Packing Density tbs./ft³ Pore Dia. Range

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Essentially nonassociated, individual molecular types of most petroleum fractions diffuse freely through the liquid phase. Convection currents then push the constituents to upper and lower regions of the apparatus.

There are no immediate commercial plans for the process because of high capital cost (\$1,400/bbl.) and heat requirements (400,000 Btu./gal. of top product). But, thermal diffusion can provide the high-temperature lubricants and motor oils eventually needed by industry.

Informed sources indicate that a company new to the CPI will build a plant in the Louisiana Gulf area to produce ethylene and other petrochemicals. Move would have major impact in the Baton Rouge-New Orleans area, where Humble is the only merchant ethylene producer.

Combination power-desalination plant offers cheaper fresh water

Extracting fresh water from sea water on a large scale may bring about a marriage of convenience between power generating stations and sea water distillation plants. Speaking at the American Power Conference in Chicago last month, Singmaster & Breyer's G.E. Sonderman suggested that such an alliance could result in savings for both the power and water plants.

A 10-million-gpd. distillation plant combined with a power plant could shave fuel cost by about 10%. If fresh water were in the \$1/M gal. range for a plant designed to operate with steam from low-pressure boilers, water from the integrated plant would cost about 90ϕ . A separate plant designed to produce water at 50ϕ would save $6\phi/M$ gal. by combining.

What would the power plant stand to gain from the association? As an indirect result of the sea water conversion facility, it might get an increased demand for power, as industry and domestic users were attracted to the area where water is available. Further, the combined facility would require lower capital charges than if the two plants were built separately, since the power plant would not need a condenser and the

water plant would not need to produce steam.

Operating costs would drop because the combined operation would use the same supervisory staff and maintenance crew, and very little more operating labor than the steam plant alone.

New family of chemicals may be bred from petronaphthalene

Besides the obvious markets in phthalic anhydride manufacture, petrochemical naphthalene may provide the starting material for a new generation of chemicals. That's the belief of Collier Carbon & Chemical, which is building a 100-million-lb./yr. naphthalene plant with Tidewater Oil at Delaware City. Del.

Collier has developed a process that extracts 2-methyl-naphthalene from the hydrodealkylation plant's feed stream, could produce 25 million lb./yr. of the new material in addition to the regular naphthalene output. Predicted use for the 2-methyl-naphthalene: starting material for making 2, 6 naphthalic acid—a dicarboxylic acid similar to terephthalic acid.

The naphthalic acid could be the raw material for a new family of polyester-type fibers and films. Several companies have already expressed an interest, says Collier.

The firm believes that with a steady supply of cheap $(6\phi/lb.)$, pure (99.99%) naphthalene, a host of other new end uses will appear. Detergent alkylates, analogous to dodecyl benzene, can be made. In the area of plastics, an active group can be attached to the naphthalene ring, producing a monomer similar in some respects to styrene.

Others are more cautious in their predictions for petronaphthalene. Ashland Oil & Refining, already on stream at Ashland, Ky., with a Hydeal unit, says there are "possibilities" in polynuclear molecules based on naphthalene. The firm dealkylates a feed stream similar to Tidewater-Collier's, could therefore produce 2-methyl-naphthalene. Ashland says, however, that no such plans are in the offing.

Hydrocarbon Research, which developed the HDA dealkylation process along with Atlantic Refining, sees no great rush to naphthalene chemistry, is currently promoting its process for production of ethylbenzene rather than for manufacture of naphthalene.

For More Industry & Economic News . . . p. 124

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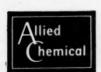
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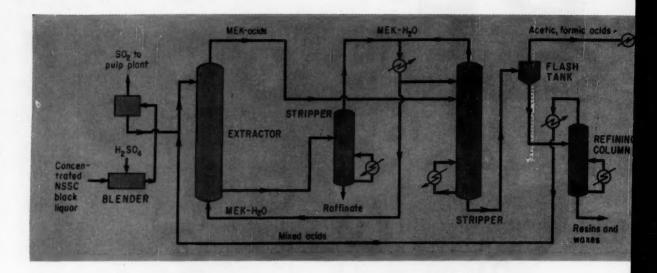
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PROCESS WRINGS ACETIC AND FORMIC ACIDS FROM SULFITE LIQUOR

Unique flowsheet enables Sonoco Products Co. to recover two acids from neutral sulfite semichemical liquor. Remaining problem: economics.

Engineers from Sonoco Products Co. recently revealed first process details of the firm's \$1.5-million acetic and formic acid recovery unit, operating adjacent to its Hartsville, S. C., pulp mill.* Main features: a novel solvent extraction step coupled with azeotropic distillation to separate the acetic and formic acids (Chem. Eng., Mar. 6, p. 73).

Sonoco developed its process to resolve problems besetting most pulp manufacturers: (1) too great a discharge of pulping liquors into rivers; (2) inability to upgrade the byproducts of the pulping operations.

In Sonoco's case, the stream in question was the nearby Black

Creek. By processing the neutral sulfite semichemical black liquor from its 350-ton/day pulp mill, the firm hoped not only to eliminate the source of river pollution but also to recover chemicals for sale and make a profit for the entire recovery operation. To date, the company has achieved the first objective but has fallen short of the second.

▶ Needed: More Time—The recovery unit came on stream in June 1958 and has been plagued by a series of technical problems, but its operation is now satisfactory. The plant is not self-sustaining economically, but Sonoco believes that it may be able to make it so in the near future.

One big factor affecting the economics: the firm's inability to make a colorless formic acid. This has prevented commercial sales of this most valuable (about 16¢/lb.) of the plant's products. (Other products: glacial acetic acid, worth about 8¢/lb., and salt cake, which can be sold to kraft mills for around \$27/ton.)

In addition to the formic color

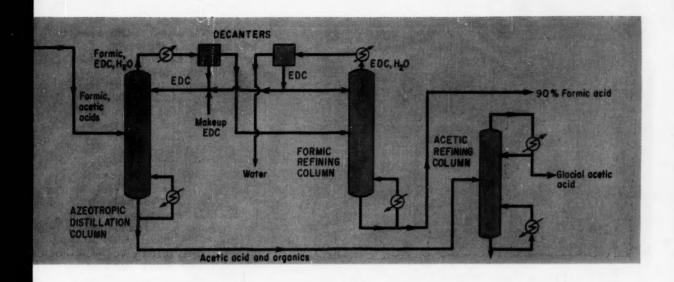
problem, the plant has encountered severe corrosion problems, especially in the refining section. These occurred despite the fact that the plant is constructed almost entirely from stainless steel—and some of it the more expensive alloys.

Initial economic studies of the process showed that geography plays an important part in the profitability of the operation: it's essential to be near potential customers. Also, to reach the breakeven point, the recovery plant must service at least a 300-ton/day mill. This was one of the factors that led Sonoco to expand its Hartsville capacity from 175 to 350 tons/day.

▶ First: Concentrate—To start the process, black liquor from the pulp mill is concentrated to 40-45% solids in a three-effect evaporator. This stream is then acidified with stoichiometric proportions of sulfuric acid in an in-line blender. Acidification frees the acetic and formic acids from their corresponding sodium salts.

Solvent extraction with methyl-

^{*} Described in paper presented before the recent Technical Assn. of the Pulp and Paper Industry meeting in New York.



ethyl ketone (MEK) then separates the mixed acids from the acidified black liquor. A fairly good separation of the MEK extract from the black liquor can be obtained because the sodium salts in the liquor prevent most of the MEK from dissolving in the aqueous phase.

The raffinate from the extractor is first stripped to remove the remaining MEK, then is evaporated to 55% solids and shipped in spe-

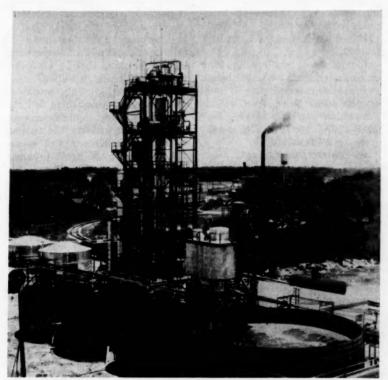
cial tank cars to kraft paper mills.

Breaking the Azeotrope—From the extraction column, the MEK-acid stream flows to a stripper that separates and recycles the MEK.

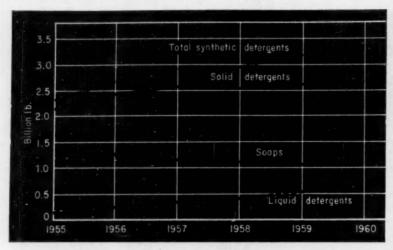
Mixed acid stream from the stripper bottom is further heated and flashed into a tank, with heavier organics settling out in a concentrated acetic-formic solution. This stream passes to a still that removes and recycles the acids. Remaining resins and waxes are sent to further processing stages being developed.

Acetic-formic acids from the flash drum are condensed and fed to an azeotropic distillation column where they are separated with ethylene dichloride (EDC). Bottoms from the column is essentially glacial acetic acid plus other organic acids and furfural. This stream is pumped to a final refining column that produces 99.5% glacial acetic acid overhead.

The formic-EDC-water stream from the azeotrope column is condensed and flows to a decanter. The formic acid layer then passes to a fractionating column against refluxing EDC. Bottoms product is 90% formic acid. The overhead is an EDC-water mixture that is condensed and passed to a decanter. The EDC flows back to the formic acid column and the water is discarded.—RAL



Distillation columns, center, separate and purify the two acids.



LIQUID SYNDET SALES SOAR AS POWDERS LEVEL OFF

Starting from scratch in early 50's, liquids now represent 20% of synthetic detergent volume, 27% of dollar value. Further gains seen.

Paced by liquid synthetic detergents, which have shown phenomenal gains in the last few years, total sales of syndets reached a new high of 3.3 billion lb. in 1960. They grabbed 75.8% of the combined soap and detergent market, which amounted to 4,367,586,000 lb.

Total soap and detergent sales were up 2.3% in volume, 2.4% in

value over 1959, according to the Assn. of Soap & Glycerine Producers.

Significantly, however, the syndets' rate of growth has slowed preceptibly. Last year's sales were only 3.3% higher than in 1959, compared with a rise of 8.5% from 1958 to 1959, and 38.5% from 1955 to 1959.

Liquid detergents are growing much faster than solids. Although representing a small part of total syndet sales, their 1960 volume showed an increase of 14% over 1959, 150% over 1956. Dollar sales were up 8.5% over 1959.

By contrast, sales of solid deter-

gents was up only 1.1% over 1959, and 23% above 1955. Dollar sales were up 1.6% for the year.

► Soap Skids Less—As has been the case for the past decade, 1960 soap consumption fell and now represents only 24.2% of the total soap and detergent market. However, the drop of 0.9% was the smallest in ten years. Dollar sales remained approximately the same.

Brightening soap's picture was the rise in sales of bar toilet soaps. They now represent about 55% of total soap sales. These bars seem to be almost immune from the inroads of syndets. Despite the heavy promotions behind such syndet bars as P&G's Zest, Lever's Dove and Colgate's Vel Beauty Bar, toilet soap bar sales continue their climb.

Also showing an increase in sales, although only about 0.2%, were scouring cleaners—1960 volume of 374,933,000 lb., value \$50,904,000. ▶ Detergents Still Gaining—Solids dominate the synthetic detergent field with 80.5% of the 1960 market. Leaders are the heavy-duty laundry products; about half solids' volume.

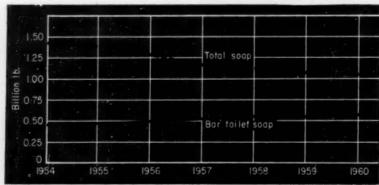
Their growth is keyed to the sale of home laundry appliances, which ran about 3½ million units in 1960. It is estimated that there are currently about 23 million washers in U.S. homes, and that by 1965 the number will reach 30 million.

Among the light-duty products, used primarily for washing delicate fabrics and dishes, liquid detergents—due to their economy and ease of handling—are already well established. They made great progress in the mid-50's and are now a big factor in this market, with 1960 sales approaching 500 million lb.

As the sale of electric dishwashers—560,000 in 1960, 547,300 in 1959—has barely scratched the surface of the potential market, the future of light-duty liquid detergents looks rosy indeed.

But the most spectacular growth is in the much newer liquid all-purpose detergents. From a small sales volume of about 35 million lb. in 1958, they have grown to approximately 170 million lb. in 1960.

Today, there are such new, but already well-known brands of allpurpose liquids as P&G's Mr. Clean,



Bars buck soap's downward trend; they sell better as total soap sales slide.

NEW LOW PRICE ON QO FA

Q0° FURFURYL ALCOHOL NOW 17.5¢* LB. DELIVERED

Demand for furfuryl alcohol, and resins made from it, has grown in older as well as new areas of application including foundry core binders, carbon impregnating solutions, and binders for carbon. Increased production and expanded sales now make possible a price reduction averaging over $1 \not\in$ a pound in tank cars on a delivered basis.

Users of furfuryl alcohol have enjoyed three major price reductions since 1953. Each reduction has made their research and use of this product more attractive than before. Shouldn't you too be studying and using furfuryl alcohol?

If you have a possible application for furfuryl alcohol or an FA modified resin, now is the time for a fresh evaluation. Write for your copy of our new price schedule.

*Effective April 1, 1961 in tank car quantities east of Denver, Colorado, U.S.A. Prices subject to change without notice.

The Quaker Oals Company

CHEMICALS DIVISION



335T The Merchandise Mart, Chicago 54, Illinois

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Quaker Oats (France) S. A., 3, Rue Pillet-Will, Paris IX, France; Imperial Chemical Industries (Holland) N.V., Rotterdam, Holland Imperial Chemical Industries (Export) Ltd., Frankfurt a.M., Germany

In Australia:

Swift & Company, Ltd., Sydney

In Japan:

F. Kanematsu & Company, Ltd., Tokyo

Lever's Handy Andy, Lestoil Inc.'s Lestoil, also a flood of lesser known brands. Their major use: to help the housewife tidy up surfaces for which she has no mechanical aids, such as walls, appliance surfaces and table tops.

These new cleaners are easy to use. The synthetic surface-active agents they contain give a maximum of cleaning with a minimum of labor. They are formulated to work well in either hard or soft water.

However, their glamor is being dulled somewhat by the introduction of a variety of convenience products, each designed for a specific task. Examples: The products now available for cleaning wall-to-wall carpets. Key to their uses are the mechanical scrubbers and applicators. As a result of these products and services, the rug cleaning business has trebled in five years.

With a major impediment—cleaning wall-to-wall carpets in place—removed, sale of broadloom carpets reached 130 million sq. yd. in 1959. Their continued popularity augurs well for these newer cleaners. But their success has already slowed down the sale of all-purpose liquids, and predictions are now being made that volume of these products will level off at about 290 million lb. in 1965.

► Heavy-Duty Liquids—The third class of liquid syndets—heavy-duty products—are the newest. Presently, there are only two on the market—Wisk and "all"—both produced and marketed by Lever Bros.

A number of other heavy-duty liquids have been test-marketed, but none has reached grocery shelves. However, two products now in the test-market stage—P&G's Gain and Colgate's Dynamo—may soon be introduced nationally.

Lever began distributing Wisk in 1956, when about 25 million lb. were sold. Since then, its sales have climbed steeply, to 50 million lb. in 1957, 75 million in 1958, about 100 million in 1959.

Prompted by the performance of Wisk, Lever launched liquid "all" in the latter part of 1959, began national distribution in 1960.

The future of heavy-duty liquid

detergents appears bright. Speed of growth, however, depends on:

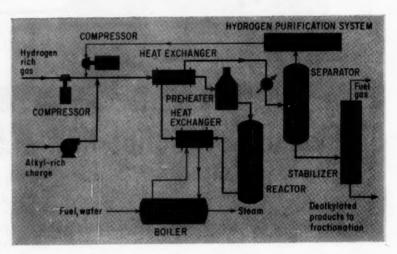
- Number of new products introduced.
- Magnitude of advertising and promotion.
- Large-scale introduction of washing machines equipped with automatic liquid dispensers.
- ► Looking to the Future—In addition to convenience, several other factors are seen favoring the continued switch to liquid detergents.
- Chemical companies have recently introduced new products and intermediates that lend themselves particularly to liquid formulations.
- Detergent manufacturers and formulators have learned how to capitalize on minor structural

changes in the surfactant molecules.

 Several of the major soap companies are said to have liquid formulations, based on the new chemicals, now under development.

But proponents of solid detergents, who have successful products on the market that represent large investments, aren't ready to give in to the liquids yet. They are said to be working on a number of convenience items such as pellets that combine detergents with inorganic salts, such as polyphosphates, immediately disintegrate in water.

Another item under development is a packet of laundry detergent in a film that dissolves in water. Fortified with such items solid makers hope to stem the tide.—AVG



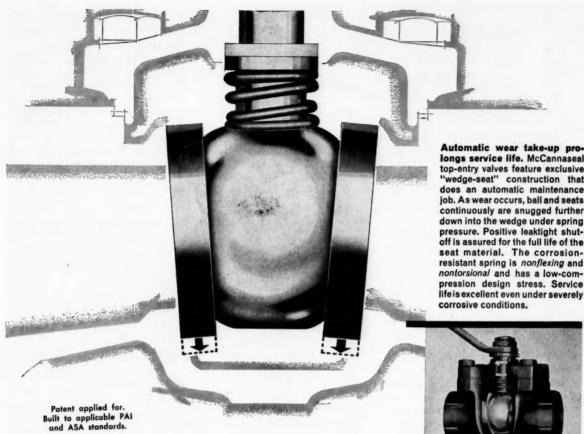
THERMAL HYDRODEALKYLATION VIES WITH CATALYST ROUTE

Atlantic-Hydrocarbon process is first to make benzene and naphthalene noncatalytically from petroleum feedstocks. It features good yield, low cost, efficient operation.

Benzene and naphthalene from petroleum sources continue to grab headlines. Another process to dealkylate with hydrogen now offers competition for the Hydeal scheme currently so prominent in the rapid expansion to produce the two aromatics.

Called HDA, the process is a joint effort of Atlantic Refining Co. and Hydrocarbon Research, Inc. (Chem. Eng., Mar. 20, p. 75).

Making use of high temperatures and pressures for the dealkylation, HDA differs radically from the catalytic methods developed by Uni-



longs service life. McCannaseal top-entry valves feature exclusive "wedge-seat" construction that does an automatic maintenance job. As wear occurs, ball and seats continuously are snugged further down into the wedge under spring pressure. Positive leaktight shutoff is assured for the full life of the seat material. The corrosion-resistant spring is nonflexing and nontorsional and has a low-compression design stress. Service life is excellent even under severely corrosive conditions.

McCannaseal® **Top-Entry Ball Valves**

... the valves with "wedge-seat" design that automatically adjusts for wear

New catalog gives complete data all types Hills-McCanna ball valves, for pressures to 1000 psi, temperatures to 600° F, manual or motor-operated. Includes dimensions, materials, Cv values, corrosionresistance data-everything required for selection and piping layouts. Send for your copy today.

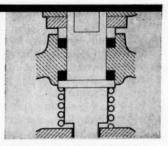
*A complete line of ball valves, 1/2" through 12" sizes for liquids, gases, vacuum . . . including models with high-temperature and fire-safe seats.



Fast quarter-turn operation from full-open to full-close. Screwed, flanged, or socket weld connections 1" to 8" sizes."



In-line maintenance. Simply remove ball and seats, reassemble with new seats, and you're back in business in minutes.



Leaktight stem seal. Double seals are under compression at all times—and the higher the line pressure, the tighter the seal.



BV61-2

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versal Oil Products (Hydeal) and Houdry Process Corp. (Detol).

▶ Basics Not Really New — The principles of thermal dealkylation have been known for a long time and the chemical reactions involved demonstrated on a small scale. But HDA is the first publicly announced commercial-scale process that can master the highly exothermic reaction and achieve an operable condition.

Benzene can be produced from a variety of feedstocks including toluene, xylenes, ethyl benzene and pyrolysis gasoline. To make naphthalene, HDA converts coal tar alkyl naphthalenes, heavy reformate, catalytic-cracker cycle stocks and pyrolysis polymers.

➤ Simple Flowsheet—In operation, the alkyl aromatic charge is mixed with a hydrogen-rich gas, preheated and fed to a reactor operating at 1,200-1,400 F., 500 psi. or more. Reactor products are cooled by heat exchange with a steam generator and the incoming feed stream, then are separated in a knockout drum that recovers unreacted hydrogen for purification and re-use.

Aromatic products are separated from paraffinic fuel gas in a stabilizer, go to fractionation for final purification.

Yields of benzene and naphthalene are said to be 96-98% of theoretical. The good benzene yield of 0.82 gallon per gallon of feed toluene is highly competitive with those reported for Hydeal and Detol dealkylation.

➤ Thermal Advantages—Although the processes are similar in most respects, the reactors may be quite different. Use of the specially designed HDA process is said to give the following advantages over a catalytic system:

 Catalyst costs (first charge and replacement) are eliminated.

 Plant investment is low because high efficiency of the process permits a smaller plant to have a capacity equal to that of a larger catalytic plant.

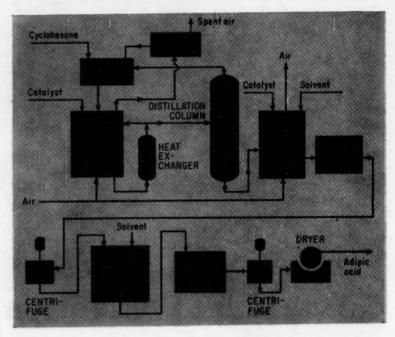
 Hydrogen consumption is low and uniform. Consumption in catalytic plants varies with changes in catalyst activity.

Current Lineup-HDA will try

to get a foothold in a hydrodeal-kylation field dominated by Hydeal. To date, Hydeal plants for benzene, operating, abuilding or planned, have a total capacity of about 120 million gal./yr.

One Detol facility under construction will have a yearly yield of 17 million gal. And Humble Oil & Refining Co. is planning to build a 25-million-gal./yr. plant, using an undisclosed dealkylation process. Industry sources opine that it may be a thermal scheme.

Petrochemical naphthalene capacity—operating, under construction or planned—now tops 325 million lb./yr. Of this, 75 million is Hydeal, the rest represents individual companies' catalytic processes.—FCP



NEW ADIPIC ACID PROCESS MAY ALTER NYLON PICTURE

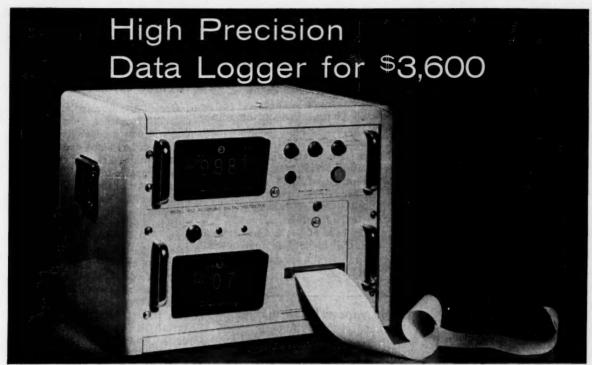
Direct oxidation of liquid cyclohexane with molecular oxygen at low temperatures gives optimum yield at minimum cost.

With the recent publication of Australian patent 61,570, covering the manufacture of adipic acid by multistage air oxidation of cyclohexane, the door was opened for entry of smaller companies into the nylon field.

Developed by Scientific Design Co., New York, the process is said to be the only one available for licensing. It employs direct air oxidation in all stages—Du Pont and Chemstrand both use combinations of air and nitric acid—should therefore overcome disadvantages, such as oxide fumes and equipment corrosion, of nitric acid.

Use of low temperatures in the first oxidation stage is said to increase the quantities of cyclohexanone and cyclohexanol in the intermediate oil, thus increase the yield of adipic acid in the second stage.

Low-Temperature Oxidation — According to the patent, liquid cyclohexane is fed to the first oxidation stage (comprising one or more



The RS2 Recording Digital Voltmeter—now in volume production at Non-Linear Systems, Inc.—scans up to 20 double-pole input channels... measures DC voltage from ± 0.001 to ± 999.9 with $\pm 0.01\%$ accuracy... and records input channel number and the 4-digit voltage measurement. Uses include research and development, quality control, environmental and reliability testing.



Volume production and simplified controls of the RS2 account for its low cost—half to a third ess than custom-built units.



Plug-in stepping switches in the digital volt-meter section of the RS2 permit replacement of all switches and decade resistors in minutes instead of days.



NLS Reports on Low-Cost, Standard Data Logger

A low-cost automatic data logger built as an integrated scanning, measuring and printing system - the RS2 Recording Digital Voltmeter - is now in volume production at Non-Linear Systems, Inc.

This economy-priced NLS logger is designed for applications requiring high accuracy and low cost without need for the higher speed and greater input capacity of higher cost NLS systems. Simplified controls offer several automatic and manual modes of operation to meet the needs of a great number of applications.

While utilizing many circuits field-tested for six years in thousands of NLS digital voltmeters, the RS2 has undergone extensive testing as a standard, complete system. It is delivered ready to use, without need for additional engineering or complex interconnections.

Call your NLS regional office or representative for a demonstration, or write NLS.

RS2 BRIEF SPECIFICATIONS

Visual Indication: 4-digit voltage reading with correct polarity and range. 2 digits for input channel identification. Range-Polarity Indication: automatio

Functions: acaning up to 20-double-pole chan-nels; measuring DC voltage from ±0.001 to ±99.93 in ranges of ±9.999/99.99/99.99; printing channel number, 4-digit reading, polarity and decimal point placement.

Accuracy: ±0.01% of full scale on each range. Speed: 2 seconds average for each data point scanned, measured and recorded.

Scanner Operation Modes: AUTO CYCLE - sys-

tem continually repeats automatic scanning cycle from channel 00 to 19. ONE CYCLE—system automatically stops after scanning channel 19. PRINT—one input is measured without advancing scanner. Scanner may be manually advanced one channel at a time by depressing front panel ADVANCE button.

AC Voltage: Use NLS AC/DC Converter.

Low-Level DC: Use NLS Model 140 Preamplifier.

Input Impedance: 10 megs on all ranges. Size: 14" high, 15¼" deep for 19" rack. Delivery: From stock. 30 days, maximum, should stocks become depleted.



Originator of the Digital Voltmeter

non-linear systems, inc.

DEL MAR, CALIFORNIA

reactors) where a catalyst such as cobalt naphthenate is added. Then, mixture is sparged with air under a pressure of about 350 psig. until 8-10% of the cyclohexane is converted. Optimum temperature of 125-130 C. is attained by circulating the liquid through a heat exchanger.

Residual cyclohexane is distilled from the liquid effluent and returned to the reactor for reuse. Remaining oil is then added to a solvent such as acetic acid containing a catalyst mixture composed of copper and manganese acetates in the second reactor and sparged with air for about 6 hr. Temperatures of 80-85 C. and pressure of 100 psig. are recommended.

When conversion of the adipic acid precursors is complete, the liquid is discharged from the reactor into a crystallization tank. Following crystallization, mixture is centrifuged. The crude adipic acid cake from the centrifuge is redissolved in acetic acid, then recrystallized and centrifuged.

The cake of purified adipic acid from the second centrifuge is then dried to form a crystalline product.

Big Benzene Buyer Will Become Primary Producer

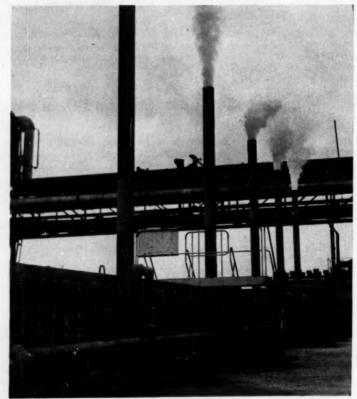
One of the world's largest purchasers of benzene, Dow Chemical Co., will now produce it as well in a new recovery plant, due on stream next month at Freeport, Tex. Plant will be capable of supplying a substantial part of the benzene requirements for Dow's styrene facility at Freeport.

Details of the process to be used have not been revealed, although it is said to involve cracking, fractionation and recycling of hydrocarbon feedstock obtained from internal sources or shipped in by barge. Therefore, it apparently differs from processes such as Universal Oil Products' Hydeal, Houdry's Detol and Hydrocarbon Research's HDA processes (Chem. Eng., Mar. 20, p. 75) chosen for plants announced earlier by other chemicals producers.

Dow's announcement, coming on the heels of a recent disclosure that it plans to build still another benzene plant at Bay City, Mich., caused increased speculation that the industry overcapacity expected by late 1962 or 1963 may be reached early next year.

Right now, however, in the present tight U.S. market, Dow buys more than 20% of the benzene sold. And withdrawal of any substantial part of this demand will certainly go a long way toward relieving this pressing shortage.

Safety report: flammable vapors leave via jet



Heavier-than-air flammable vapors are dispersed in short order by this steam ejector system developed by Britain's Imperial Chemical Industries, Ltd., for its plants that produce or handle liquefied hydrocarbon gases. Equipment for this ICI propylene injection plant is contained within a brick-walled compound around which are placed ducted stacks connected to steam ejectors. When sampling instruments warn of a dangerous concentration of gases, jets are turned on, rapidly sucking the vapors up through the ducts shown, and dispersing them into the atmosphere.

India Allocates \$500 Million For Nitrogenous Fertilizers

As projects continue to pour off the drawing boards in India's third Five Year Plan, it's clear that emphasis is being placed on nitrogenous fertilizers.

Target is an eightfold jump in nitrogenous production—to 1 million tons/yr. by 1965-6. India now makes 158,000 tons/yr. herself, has to import over three times that amount to nourish her annual crop.

Current plans call for spending \$500 million of state funds for government-owned nitrogenous fertiB&W Kaocrete-B being gunned inside fixed bed desulfurizer vessel.



B&W
KAOCRETE-B
...unexcelled
for gunning
in overhead
applications
with minimum
rebound loss

B&W Kaocrete-B, a specially developed refractory castable is excellent for gunning in vertical or overhanging applications with low rebound loss.

Kaocrete-B is suitable for temperatures encountered in most refining and petrochemical applications. It is extremely easy to apply because it has sufficient plasticity to adhere readily to mesh and walls. Kaocrete-B's low density permits a minimum amount of material to be used, thereby lowering the refractory weight and reducing material cost. Because of its relatively low iron content, B&W Kaocrete-B can be used in most process atmosphere applications.

B&W makes a line of specialized refractory castables which is widely used in the petroleum, petrochemical and chemical industries. Bulletin R-35B contains complete information on B&W Refractory Castables. Send for your copy to: The Babcock & Wilcox Co., Refractories Division, 161 East 42nd Street, New York 17, N. Y.



THE BABCOCK & WILCOX COMPANY

REFRACTORIES DIVISION

B&W Firebrick, Insulating Firebrick, and Refractory Castables, Plastics, Ramming Mixes, Mortars, and Ceramic Fiber.

lizer units. Another \$500 million is being solicited from private investors, both Indian and foreign. Projects include:

· A 1.200-ton/day government plant already on stream at Nangal (Punjab State).

· Another state-owned unit. designed to make 250-tons/day, being engineered by Chemical Construction Corp., at Trombay.

· In the private sector, three 230-ton/day facilities licensed for southern India.

April 15, the exhibit will travel to some 16 major North American cities for 30-day showings during 1961-1963. It will include 30 individual units, demonstrating plastics materials as well-designed endproducts for use in buildings. Four major areas covered: background and introductory information, constructural, interior furnishings, decorative and aesthetic.

In the new "Chemosphere" house, sponsored by Chem Seal Corp.,* epoxy and polysulfide compounds were used in 28 different applications to produce a structure welded together from roof to base pad with chemical structural adhesives. All nails, bolts, screws and other metal or wooden fasteners commonly used were completely eliminated.

By mixing the epoxys and polysulfides with varying quantities of other materials, such as sand and cement, an infinite variety of bonding, sealing and coating materials were produced to an exact degree of hardness and flexibility.

For example, an epoxy adhesive

*Chem Seal Corp. of America, 12910 Panama St., Los Angeles 66, Calif.

DRIVING HOME PLASTICS STORY TO RESIDENTIAL BUILDERS

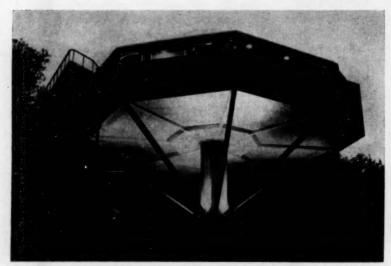
hard to increase its present 5% share of the \$15.5 billion spent on materials for new construction.

Communication is the major problem. To develop markets, the loosely knit building industryarchitects, engineers, contractors, material suppliers, labor, regulatory agencies, financing concerns -needs briefing. Most are not well enough informed on materials available, properties, uses and mismese.

One technique that's proving effective is the building of demonstration houses such as the new type shown below at Hollywood

The chemical industry is driving Hills, Calif. Called the "Chemosphere" house, it stands on a concrete column, 30 ft. high, sunk in the side of a steep hill. Other examples: Monsanto's House of the Future, at Disneyland; the National Assn. of Home Builders' research houses; use of new materials and components in residential developments fostered by Action. Inc., New York.

And this month, the Society of Plastics Engineers launches its first educational and technical traveling exhibit, which will be centered about the theme. "Plastics -A new Dimension in Building." Opening in Springfield, Mass., on



"Chemosphere" house shows what plastics can do for modern home design and construction. Mounted atop a 5 x 30-ft. concrete column, the structure is held together with polysulfide polymers and epoxy resins. In the pictures on the right, owner-builder Leonard Malin and helpers are surfacing the roof. A wood pulp mat goes down first, joined by strips of fiber glass. Over this mat, Malin applies three coats of epoxy compound. In the top picture, he is squeegeeing and rolling the second coat; below, you see chopped fiber glass being sprayed onto fresh third coat, prior to final rolling.





Lock your Hazards in a

and Gage <u>Safely</u> and <u>Accurately</u> with **JERGUSON MAGNETIC GAGES**

Jerguson Magnetic Liquid Level Gages give you accurate liquid level and interface readings . . . with absolute safety . . . when you're dealing with problems of dangerous liquids, toxic gases and corrosion. You eliminate the dangers inherent in glass and its gaskets, and in threaded connections . . . for you lock your hazards in a solid-wall chamber, flanged to the vessel being gaged.

Indicator Operated Through Chamber Wall

The unique design of the Magnetic Gage places a float with an actuating magnet inside a sealed chamber and an indicator mounted outside the chamber. The indicator is magnetically operated through the chamber wall. The chamber is completely sealed so there is no danger of gases or fluids escaping.

The level indicator consists of edge-magnetized wafers which rotate. As liquid levels change, an accurate reading is shown as a red column contrasted with silver above.

Four Models; Job Correlated

Jerguson Magnetic Gages are available in four models to fit a variety of installation needs. The float is adjusted for specific gravity and correlates pressure, temperature and specific gravity.

In Use on a Variety of Liquids

Many prominent Chemical and Petrochemical Companies have installed these Magnetic Gages for liquid level or interface reading. They will handle any liquid, and are in such varied services as: many hydrocarbons, including lube oil, ethyl mercaptan, etc., alcohol, ammonia, hydrofluoric, sulphuric and other acids, liquid nitrogen, caustic soda, high-pressure feed water and many others.

Why invite expense and danger when you can eliminate your hazards with this safe, accurate Magnetic Gage?



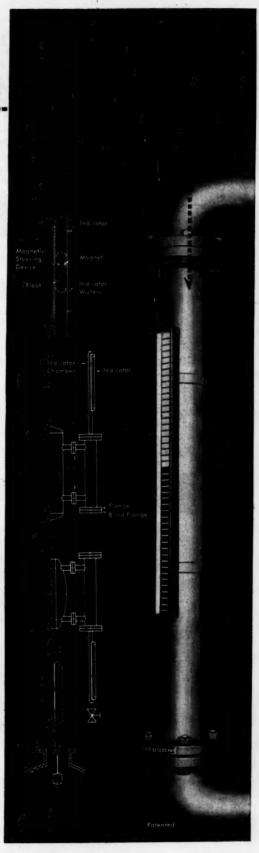
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Liquid Level and
Large Chamber Gages
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Gages and Valves for the Observation of Liquids and Levels
JERGUSON GAGE & VALVE COMPANY
100 Adoms Street, Burlington, Mass.
Offices in Major Cities.



bound and sealed the supporting column to its thick concrete pad, meeting city building requirements, which originally had called for monolithic construction.

Chemicals Surplus Seen During Coming Decade

The next decade promises to force most chemical-industry segments into closer and closer contact with the hard realities of competition. The special privileges that insulate the new and unique are fast receding from noncellulosic fibers and plastics, from their rawmaterials suppliers in coal chemicals and aromatic intermediates, and from pharmaceuticals. Only fertilizers and pesticides seem to be assured steady growth.

Representing the synthetic fiber industry at a recent Commercial Chemical Development Assn. symposium—titled "Did 1960 Foreshadow the Decade?"—Edward T. Powers, Chemstrand Corp., saw noncellulosic fibers losing their past

immunity to the cyclic excesses that characterize the textile industry's economy. He noted that projections for 1960 noncellulosic fiber demand were $6\frac{1}{2}\%$ too high, with nylon and polyester forecasts closer to reality than those for acrylics.

By 1964, consumption of noncellulosics should hit the billion pound mark. But installed capacity will reach the 980-million-lb. level by the end of 1961, three years ahead of demand. Powers' view of the road ahead: fierce interfiber competition.

Looking at plastics, C. M. Blair of Union Carbide Plastics plucked out polyvinyl chloride as exemplifying general problems of overcapacity and declining prices. Between 1955 and 1960, PVC sales grew 12%; capacity, 15%; nine more producers entered the field. But prices dropped 7½¢ through 1959 and some more in 1960. Even with no further expansion, Blair sees PVC in overcapacity up to 1965. His evaluation of high-pressure polyethylene puts it about where the vinyls were in 1956.

More optimistic were Emanuel

Heinberg and W. R. Yoder discussing fertilizers and pesticides, respectively. Heinberg expects U. S. fertilizer consumption to increase 6 to 10% in 1961. Pesticide sales, grown sevenfold in 20 years are in for a tenfold increase during the 1960's.

Australia's CPI Moves Upward, Buoyed by U.S.

Just published by Australia's Dept. of Trade, a revealing study* of the Commonwealth's CPI discloses a healthy growth pattern. Examples: caustic soda production doubled in the past 10 years; superphosphate fertilizers jumped 10% during '60 alone; amount of crude oil refined in '59 was 13 times the '50 tonnage; and paperboard consumption in '60 was 25% above '57 levels.

Much of this thrust has come from U.S. capital (which reached the \$1 billion mark this year), with more than a thousand American firms now associated with Australian companies.

*"Survey of Manufacturing Activity in Australia," available free from the New South Wales Govt. Office, 680 Fifth Ave., New York 19.

Soviet Distillation Record: Research Tops Practice

Russian distillation techniques and practices appear to be about 10-15 years behind those of the U. S., according to a report issued by the Office of Technical Service of the Dept. of Commerce.

OTS indicates that the gap is largely in the area of applied research, where Soviet engineers make little or no use of mathematical statistics in either the design or operation of distillation equipment. Typical literature reports contain voluminous quantities of data without any supporting statistical analyses.

In basic distillation research, Russian efforts compare with those here, although their work is mostly done by physical chemists.

Liquid ethylene comes in large, insulated package



Recently inaugurating a regular run between Sarnia, Ont., and Humble Oil's Bayway refinery at Linden, N. J., this giant refrigerated trailer carries 30,000 lb. of liquid ethylene, holding it at -140 F. for the 20-hr. trip. The ethylene will be used to supplement Bayway's present output until a 35% expansion to 175 million lb./yr. is completed early in 1962.

VERSATILE POLYMERS FOR ADHESIVES AND SEALANTS!

VISTANEX® LM

BUTYL

VISTANEX LM

Polyisobutylene polymers of viscous, soft, gummy consistency having average molecular weight range of 8,700 to 11,700.

BUTYL

Isobutylene-Isoprene co-polymers of solid rubber consistency having average molecular weight range between Vistanex LM and MM.

VISTANEX MM

These polymers, because of their excellent resistance to aging, ozone and chemicals, viscosity stability over wide temperature range, and their permanent tack, offer the compounder great latitude in designing and formulation for:

- Cements
- Pressure sensitive adhesives
- Laminating adhesives
- Caulking and sealing compounds
- Tackifiers
- Blending with polyethylene or wax

Also for other applications such as: impregnating leather, binder for eraser compounds and base for paints.

EXCITING NEW PRODUCTS THROUGH PETRO-CHEMISTRY

ENJAY CHEMICAL COMPANY

A DIVISION OF HUMBLE OIL & REFINING COMPANY

VISTANEX MM

Polyisobutylene polymers having a high degree of elasticity and average molecular weight range of 64,000 to 135,000.

FOR INFORMATION on any of these materials contact Enjay at 15 West 51st Street, New York 19, N. Y.



CPI News Briefs

- · Processes
- · Plants
- · Offices
- · Companies
- International

Processes

Heat-resistant copper alloys, posessing the electrical conductivity of pure copper, have been developed in the Soviet Union, according to the Hungarian journal, Technika. Electrolytic copper powder, along with 1-5% Al₂O₂, 1-10% MgO and 1-5% SiO₂, is subjected to a reducing atmosphere of hydrogen at 660 F. for 30 min.

Resulting semifinished powder is pressed into desired shape, is again subjected to hydrogen treating at 1,830 F. for 3 hr. Final pressing at 1,470., followed by heat treatment at 750 F., gives a sintered product of close to theoretical density. Oxidation tests at 930 F. show that these alloys have oxidation resistance superior to that of pure copper.

Welding with explosives, a process discovered by American Potash & Chemical, may prove to have applications in manufacture of corrosion-resistant pipe and vessels. In the process, an explosive charge acting through an inert transmission medium, such as water, forces the two metal pieces together, forming a permanent bond without application of heat. Bonds such as aluminum to stainless, aluminum to carbon steel, aluminum to nickel alloys, and stainless steel to nickel alloys have been achieved.

One immediate application could be the bonding of corrosion-resistant metal tubing inside carbon steel pipe to achieve a combination of high chemical resistance and low cost.

Selective dimerization of propylene, to form 2-methyl-pentene-1 exclusively, can be achieved in the presence of triethylaluminum catalyst, reports Charles F. Mackey of Texas Alkyls, Houston. Such a dimerization is believed to be at the heart of the Goodyear-Scientific Design isoprene process. (In that route, the double bond on the dimer is rearranged, followed by demethanation to form isoprene.) Using the same catalyst, similar selective dimerizations can be effected with butene-1, pentene-1 and other olefins.

Plants

Dow Chemical Co. announces that it will go on stream May 1 with a benzene recovery plant at Freeport, Tex. Company has not disclosed the process to be used, states that it will involve cracking, recycling and fractionation. Feedstock will come both from other Dow units and outside sources. Plant will be able to furnish a "substantial part" of the benzene requirements for styrene processing by the firm's Texas Div.

El Paso Natural Gas Co. will build a hydrocarbons recovery unit near Jal, N. M., to provide raw materials for the company's refinery and petrochemical complex at Odessa, Tex. Input will be 650 million cu. ft./day natural gas, and the plant will recover 5,600 bbl. ethane, 7,000 bbl. propane and 1,320 bbl. butane daily. These products will be shipped as a mixed stream via a 58-mi., 6-in. pipeline from Jal to Odessa.

Pall Corp., Glen Cove, N. Y., announces that its subsidiary, Fibrous Glass Products, Inc., will build a 10-million-lb./yr. glassmaking and fiber drawing plant at Wilkes-Barre, Pa. The integrated facility will cost \$1.8 million, will produce a high-quality glass fiber for making thermal, acoustical and shock insulation, disposable filter cartridges and other products. It is to be on stream by January.

California Chemical Co., San Francisco, a subsidiary of Standard Oil Co. of Calif., announces that its Oronite Div. is undergoing a million-dollar expansion at its Oak Point, La., plant. Due to be completed later this year, the project will extend current production of a new Oronite lubricating-oil additive that is used in making compounded lube additives. Among the facilities being installed is a specially designed oil heating system.

Linde Co., Div. of Union Carbide Corp., will build an onsite, 350-ton/day oxygen plant at Ecorse, Mich., to supply Great Lakes Steel Corp. Facility will be adjacent to a 500-ton/day unit from which Linde currently furnishes oxygen for the steel firm (Chem. Eng., Jan. 9, 1961, p. 134). The new plant is scheduled for completion in mid-1962.

Monsanto Chemical Co. is producing highly concentrated phosphoric acid at a new plant at Addyston, Ohio. Called Phospholeum, the product corresponds to 105% orthophosphoric acid; its major applications are expected to be in the surface metal treatment and in use as a dehydrating agent for the plastics and petroleum industries.

Texaco Inc. has completed an expansion of its ammonia facilities at Lockport, Ill., increasing design capacity from 180 to 220/tons operating day. Company installed additional compressors as part of the program, also modified existing process equipment.

Linde Co. has also completed an onsite oxygen plant for Emery Industries, Inc., at Cincinnati. Emery will convert the oxygen to ozone, which it uses in turn to oxidize oleic acid for production of pelargonic and azelaic acids and other derivatives. Linde's new plant replaces a liquid-oxygen-supply system previousy employed by Emery, and provides sufficient capacity to handle the

CPI News Briefs continue on page 212

New Money Makers for Industry:

KIN TEL CLOSED CIRCUIT TV SYSTEMS

what they are, and what they can can do for you...

What is a KIN TEL Closed Circuit TV system?

The basic KIN TEL closed circuit TV system consists of a camera, camera control unit, and monitor, each connected by cable. The camera can be located at great distance from the monitor, and any number of monitors may be used to display the same picture.

Cameras are small enough to hold in your hand; rugged enough to operate in virtually any environment; versatile enough to cover (via remote control) almost any area; and sensitive enough to provide excellent pictures of subjects illuminated by a single candle.

The camera control provides automatic operation.

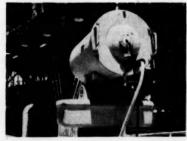
The system is continuously self-adjusting for wide variations in light levels (several thousand to one), and features automatic high definition of bright objects. The only control you have to touch is the on-off switch.



The monitor displays a crisp, clear picture...full 650-line resolution, twice that of the best home TV reception.

How are such systems used?

Today, KIN TEL TV systems are performing a number of jobs for hundreds of firms, safely, inexpensively, tirelessly. They are being used to watch operations or events that are tedious, difficult, dangerous, or even impossible for men to watch.



For example: Convair (above), Douglas, Lockheed and Northrop watch rocket tests with KIN TEL systems. U.S. Steel uses one to see inside open hearth furnaces. Westinghouse watches nuclear power reactor tests with one.

They are being used for surveillance.

For example: The San Francisco Naval Shipyard uses one to guard against pilferage.

They are being used for traffic control.

For example: The Alameda Naval Air
Station uses a KIN TEL TV system to

observe aircraft landings on the portion of the runway that is not visible from the control tower.

They are being used to transmit visual information quickly and accurately; for remote observation of charts, meters, graphs, schedules, blueprints, photographs, images from microscopes, fingerprints, signatures...the list is almost endless.

For example: E. F. Hutton uses a KIN TEL system to transmit stock market quotations to the offices of the firm's executives. The Los Angeles Department of Water and Power uses one for remote viewing of water-level meters. The University of California teaches physics with one.

They are being used for monitoring any operation that normally requires standby personnel.



For example: American Potash and Chemical (above) monitors conveyor line and warehousing operations with a KIN TEL TV system.

Why do these firms choose a KIN TEL system?

For a variety of reasons.

First, reliability. KIN TEL TV is designed for continuous duty operation in severe environments. Day in and day out, it keeps working. It's the first choice for ICBM and other missile programs that really depend on TV, that can't chance failure, that can't afford to compromise with reliability.

Second, picture quality. KIN TEL TV presents clear, sharp pictures. Full 650-line resolution provides maximum data...essential for quantitative observation of complex operations or transmission of printed material.

Third, automatic operation. KIN TELTV is the only closed circuit system that provides entirely automatic, throughthe-lens compensation for light-level changes of several thousand to one.

Fourth, the KIN TEL closed circuit TV system is extremely sensitive. The light required to read this page is enough for sharp clear pictures, and usable pictures can be provided with less than one-foot candle illumination.

Fifth, KIN TEL TV systems are easy to install and simple to operate. With no changes in lens iris to make, with no difficult, interacting electrical adjustments required, the only thing the operator has to know is the location of the on-off switch.

Sixth, a complete line of shelf-item system components and a variety of cameras and monitors make virtually any application feasible...permit observation of nearly every kind of operation, under all kinds of conditions.



For example, with system components, you can remotely position the camera, remotely select one of several lenses, remotely "zoom" in or out for closeup or wide-angle viewing, operate the camera in extremes of temperature or in explosive or dusty atmospheres, view microscope images. Whatever your viewing problem, KIN TEL probably has a stock solution.

Seventh, you don't have to waste your time and money on application engineering. At no obligation to you, KIN TEL's nationwide factory-trained field engineers – thoroughly experienced in optics, environmental requirements, lighting, cabling, human engineering factors, and other installation considerations—can determine whether or not closed circuit TV can be put to profitable use in your intended application.

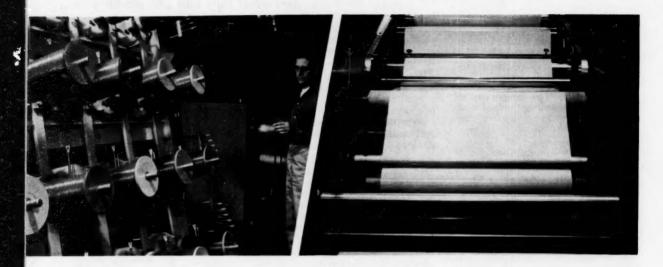
What can a KIN TEL system do for your business?

It can do what it is doing right now for hundreds of other firms. It can save you time and money...increase efficiency...better your service to clients and customers. To find out how, write direct for catalog 6-205 and the name of your nearest KIN TEL engineering representative.

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KIN TEL-pioneer and leader in closed circuit television.





POLYPROPYLENE BOOM IS UNDER WAY

With potential propylene capacity estimated at 20 billion lb./yr., the number of polypropylene manufacturers and new polyolefin products keeps on growing every day.

Last month, at the A.I.Ch.E. meeting in New Orleans, H. A. Mitchell of Shell Chemical reported that demand for propylene and propylene derivatives as petrochemical starting materials can easily be met by refiners:

Although the total propylene potential from cracking operations is estimated at about 20 billion lb./yr., slightly more than 2 billion lb./yr. is currently used as chemical raw material—the bulk of which goes into the manufacture of isopropyl alcohol (1 billion lb./yr.) and synthetic detergents (570 million lb./yr.).

But according to Mitchell, the most promising outlook for propylene is in the general field of polyolefins.

As if to prove Mitchell's statement, Eastman Chemical and Enjay Chemical recently joined the growing number of polypropylene manufacturers and have announced full commercial availability of various polypropylene grades.

Eastman is putting on stream a 20 million lb./yr. plant at Longview, Tex., and Enjay has potential polypropylene capacity of about 40 million lb./yr. And, in March, Dr. E. T. Severs of AviSun Corp. released details of a new oriented polypropylene film (still in the market development stage) at the National Packaging Exposition in Chicago.

Although chemically similar, the new polypropylene grades are specifically tailored for the production of different products.

Eastman, with its two new catalytic processes (no details available) that are claimed to be improved versions of the Ziegler-Natta process for linear atactic polyolefins, turns out a clearer, glossier, low-ash product that claims the widest range of flow rates (an important factor to plastic processors) in doing any mold-



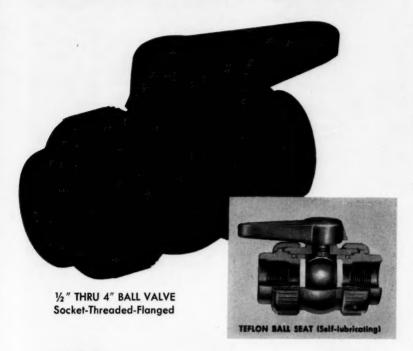
Polypropylene monofilament goes into webbing for lawn furniture.



Plastic toy. Children won't find it easy to break.

Full Flow-Self Lubricating CHEMTROL BALL VALVE

...in non-corrosive plastics



PVC I

Basic polyvinyl chloride with excellent chemical resistance...a time proven plastic. PVC II

Higher in impact strength than PVC I but slightly less resistant to some chemicals. PENTON

High operating temperature limit with an extremely wide range of chemical resistance.

ABS (Acrylonitrile Butadine Styrene) and Polypropylene also available on request.



1/2"-34"-1" 3-WAY VALVE Socket-Threaded-Flanged



1/2" THRU 4" CHEM-FOOT VALVE Socket-Threaded-Flanged



1/2" THRU 4" CHEM-CHECK VALVE Socket-Threaded-Flanged

In addition to the above, Chemtrol offers a wide range of Needle, Globe, and Cock Valves. Each can be supplied in materials to perform under most chemical resistance requirements.

Newly added to the widest range of Plastic Valves...

THE CHEMTROL OPERATOR VALVE

Now the full-flow CHEMTROL Ball Valve, can be actuated remotely by PVC piston within a PVC cylinder. Air or hydraulics may be employed to move the piston. Automatic operation can be provided through the use of a solenoid valve.



Operation from full-open to full-closed is accomplished in one-half second, providing instantaneous control. In areas where a remote controlled valve is desired, especially in corrosive environment—the new Chemtrol Operator is your answer. For complete information on Chemtrol valves, please write...

KRALOY/CHEMTROL CO., Industrial Division 402 W. Central Avenue, Santa Ana, California ing job. With pelletized color concentrates, this plastic could also gain thousands of color effects.

This polypropylene grade, called Tenite, will find its major consumption outlets in automobile parts (instrument housings, handles, panels, knobs), household appliances (television sets, washing machines) and housewares, where it will compete fiercely with styrene, nylon, acrylics, polyethylene, polyformaldehydes and other plastics.

In monofilaments, polypropylene has a large projected growth but, again, it will have to compete with other polyolefins and with Saran. Some of the monofilaments, particularly those extruded for outdoor applications, contain ultraviolet inhibitors that make the material weather-resistant.

Although polypropylene has the lowest density (0.88) of any solid plastic, its tensile strength (5,000 psi.) and hardness are the highest of all commercial polyolefins. Its softening point of 300 F. [Vicat] is also high for a thermoplastic, and molded articles can withstand common sterilization temperatures,-Eastman Chemical Products, Inc., Kingsport, Tenn. 140A ► Stable to Oxidation — Identified as Escon 125, Enjay's product is of molding grade (melting point 335 F., melt index of 5.5 at 230 F.) reported suitable for applications in which molded parts are subjected to repetitive, prolonged heat exposure, such as backs for television sets, radio cabinets, cable connectors, clothes dryers, lighting fixtures and diffusers.

Escon's attractiveness rests on its oxidative stability, and test specimens have withstood more than three months of oxidative aging at 300 F. After more than six months at 250 F., other specimens showed no evidence of failure. - Enjay Chemical Co., New 140B York. ▶ Higher Strength by Stretching— Still under development, Olefane U is an oriented polypropylene film with about twice the resistance to moisture and gas seepage as unoriented film.

According to Dr. Severs of AviSun, the orientation process—a physical stretching of the plastic—increases the tensile properties of polypropylene film: it doubles the strength in the lengthwise direction to 9,000 psi. and strengthens the film as much as eight times, from 3,200 to 25,500 psi., crosswise.

Stiffness, too, is more than doubled and the properties, surprisingly enough, are well balanced between length and width, indicating that the film will remain flexible whether cross or in-line feeding is used in a wrapping machine.

Reduction in impact strength, one of the shortcomings of unoriented film, which weakens rapidly as the temperature decreases to 0 F., won't occur with the oriented polypropylene, which keeps considerable strength even at 0 F. Although Olefane U reaches a maximum shrinkage around 330 F., the film can withstand the majority of applications encountered in packaging because shrinkage is negligible below 250 F.

The product has yet to overcome the problem of heat sealability because it has a narrower heat seal range than unoriented film and tends to pucker if weight is not applied during sealing.—AviSun Corp., Philadelphia. 140C

Metal composites

Material resists elevated temperature cycling, without leakage.

A new molybdenum-silver composite has properties that meet the requirements for seal applications having temperatures up to 1,200 F. and pressures of 5,000 psi.

Developed for the U.S. Air Force, the composites are made by impregnating a porous body of fiber metal (usually molybdenum or stainless steel) with a soft metal such as silver or magnesium. The resiliency of the fiber metal skeleton combines with the softness and conformability of the impregnant, giving a seal material for almost any static high-pressure and high-temperature purpose. In addition, the metals won't corrode in presence of chemicals, exotic fuels or hydraulic fluids.

The fiber metal skeletons—made by felting, compressing and then sintering the metal fibers to form a bond between them at each point of contact—can be produced as dense as desired and, therefore, tailored to meet different seal needs. They can be machined to desired shapes and configurations by being temporarily impregnated with salt.

In general, the temperature that a seal will withstand depends on the melting temperature of the metal filler. When the fiber metal skeleton is impregnated with the filler, the material literally becomes a sponge within a sponge. And because both metal networks are continuous, the material optimizes the combined properties of each.

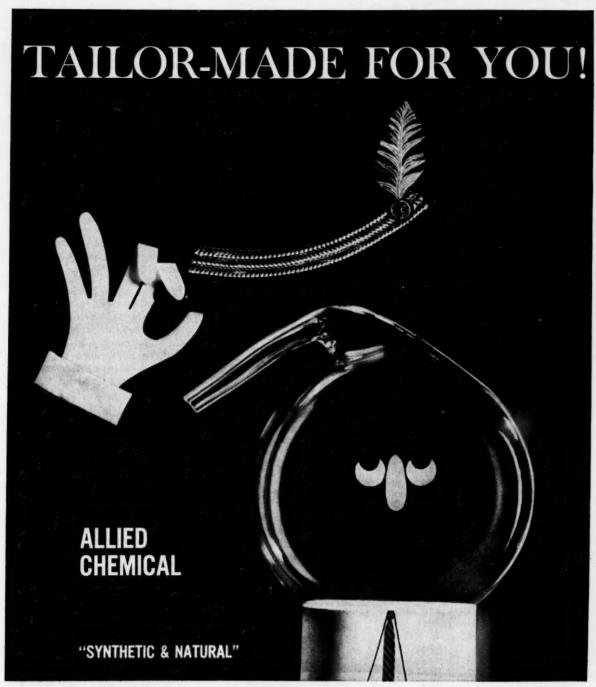
The composite, which was made

Newsworthy Chemicals-

Page number is also reader service code number

New polypropylene grade claims wide range of flow rates140A
Polypropylene molding grade offers oxidative stability
Orientation process doubles strength of polypropylene films140C
Mo-Ag composite withstands up to 5,000 psi. and 1,200 F142A
Melamine-formaldehyde cures enamels quickly without catalysts144A
Urethane foam sprayed under bridges prevents premature icing144B
Powdered alkaline cleaner prevents corrosion144C
Aluminum coating weatherproofs metals, wood and masonry144D
Epoxy resin speeds up patching of concrete floors144E
Aluminum alloy features high strength and ductility144F
24-kt. gold plating on Cu, Ni, Fe, Pb is possible without current144G
Glass-fabric epoxy laminate won't halo or edge-lift144A
Rubber-base adhesive fights corrosion, is antistatic144I

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Whatever your process or product, Plastics Division Phenol is tailor-made for it. Keep in mind that only Allied can supply you with every grade—both synthetic and natural. Our synthetic phenol is made to the most rigid specifications and is ideal for all applications. In fact, not every producer can supply phenol pure enough for Nylon 6! Our expanded phenol production due this fall assures you of ample supply. And our new synthetic phenol storage facility in Toledo, Ohio, means we can furnish overnight tank truck service in both the East and Midwest. Let us present our complete phenol story to you—Purity,

Overnight Service, and the savings which might be yours in the natural grades.

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BASIC TO AMERICA'S PROGRESS

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of molybdenum fiber skeleton and impregnated with silver, retained hot air pulsating pressures from 0 to 5,000 psi. at 1,200 F. In other evaluations, the same material was subjected to temperatures cycled from about 72 F. to 1,000 F., with the same pulsating gas pressures (0-5,000 psi.) applied at both temperature extremes. After three such temperature cycles, neither trace of leakage nor loss of bolt torque was detected.—Armour Research Foundation, Illinois Institute of Technology, Chicago. 142A

Melamine formaldehyde Resin gives fast-curing enamels without catalysts.

Identified as an etherified melamine formaldehyde resin solution of 50% solids content in isobutanol, Resimene 872 produces automobile body enamels that cure quickly at temperatures as low as 180 F. without catalyst. Used with alkyd resins, this product makes baking enamels that are also suited for finishing appliances, equipment housings and other metal products where a wide range of cure schedules must be met.

Enamels formulated with Resimene can be baked, for example, at schedules varying from 30 min. (at 180 F.) to 10 min. (at 300 F.) with a reported high color retention and minimum gloss differential even when overbaked.

Wide choice of time and temperature combinations permits the reduction of baking costs either by increasing the throughput or decreasing the heat requirements per unit. Moreover, when components are baked at different schedules, Resimene eliminates mismatched color and gloss.—

Monsanto Chemical Co., Springfield, Mass. 144A

For More Information about any item in this department, circle its code number on the Reader Service Postcard (Page 251)

Insulation

Sprayed under highway bridges, urethane foam cuts premature icing.

Foam plastic can now insulate highway bridges that normally become dangerously icy even when their approach roads are still safe.

When sprayed to the underside of highway bridges, urethane foam is also expected to reduce rapid deterioration of bridge decks, caused by frequent freezing and thawing or by the use of large amounts of de-icing salts.

According to G. P. Oldham, vice president of Allied Chemical's Barrett Div., "an inch of urethane has about the same insulating capabilities that 2 to 5 ft. of earth provide beneath a road surface... tests showed that when snow or freezing rain fell, the insulated [bridge] lanes remained free from ice about as long as the approach road surfaces built over the earth. The adjacent uninsulated lanes were icy much sooner."

Waterproof and unaffected by aging, this urethane insulation doesn't present any structural problems for application: a 1-in.-thick slab weighs only about 3 oz./sq. ft. Applied with a special spray gun that mixes two liquid components in its nozzle, the urethane foams up and solidifies onto concrete or steel within seconds, without any surface preparations.—Barrett Div., Allied Chemical Corp., New York. 144B

Briefs

Alkaline cleaner, Sprean 66, is a powdered product for spray wash of steel, copper, brass and aluminum. It prevents scale formation on heating coils, spray nozzles, and inhibits corrosion of steel parts and equipment.—Enthone Inc., New Haven, Conn. 144C

1030 Green aluminum coating weatherproofs metal, wood and masonry. Tough, durable and attractive, the green finish resists moisture, sun, and most fumes, when sprayed, rolled or brushed on as a topcoat on tanks, metal roofing, wire fencing, piping and the like. — Rust-Oleum Corp., Evanston, Ill. 144D

Epoxy-resin floor overlay tradenamed Durok Durepok is applied by trowel, can be patch-repaired to a smooth-featured edge. Surface is nonporous, hard, flexible and resistant to acids, alkalis and solvents. Also applicable by brush in a liquid form, it dries quickly to protect wood or concrete floors under heavy traffic.—Durok Building Materials, Inc., Hastings-on-Hudson, N. Y. 144E

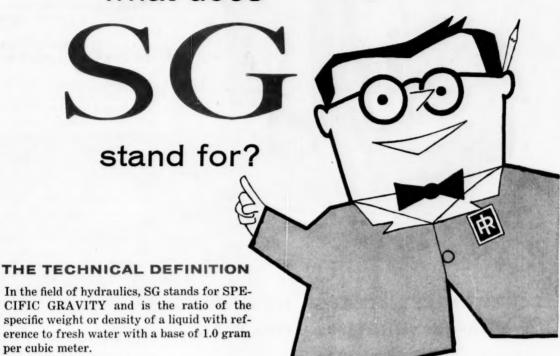
Aluminum alloy #5252 for antident auto trim has ultimate strength of 35,000 to 45,000 psi.; yield strength of 30,000 to 40,000 psi. in optimum ductility range. Anodized appearance is another feature. — Kaiser Aluminum & Chemical Corp., Oakland, Calif.

Neutral-immersion 24-kt. gold can be deposited in thin plates (to 70 millionths of an inch) directly on Cu, Ni, Fe, Pb, brass and solder without anodes or currents. Oromerse process takes about half an hour.—Technic, Inc., Providence, R. I. 144G

Glass-fabric epoxy laminate, dubbed NEMA G-10, features flame retardancy, superior cold-punching, increased solvent resistance. Copper-surfaced or plain, the laminate won't "halo" or edge-lift, thus allowing closer and intricate hole punching in printed circuit board applications even at room temperature. — Continental-Diamond Fibre Corp., Newark, Del. 144H

Synthetic - rubber - base adhesive named Rez-N-Glue #159 provides tough, elastic, antirust black coating that resists oil, gasoline, water, heat and cold. It also conducts static charges from metal, glass, some plastics and most porous materials. Heat resistance and toughness increase with age; corrosion resistance is promised with two or more brushed-on coats.—Schwartz Chemical Co., Inc., Long Island City, N. Y.

when you discuss pumps what does



BUT THERE'S ANOTHER MEANING TOO

From a product standpoint Ingersoll-Rand also likes to think of SG as "SUPERIORITY GUARANTEED"...the extra value in design, workmanship and efficiency offered when an Ingersoll-Rand centrifugal pump is selected for your application.

If you are having a pumping problem why

not look into the added values of Ingersoll-Rand centrifugal pumps. Naturally our personnel are well aware of the effect of specific gravity on pump performance. There are pump specialists in every I-R branch office. Call them or see an authorized distributor of our complete commercial line of pumps.



Close-coupled Motorpumps ¼ through 75 hp-1, 2 and 4-stage models. Capacities to 3200 gpm — heads to 650 feet. Also available in self-priming models.



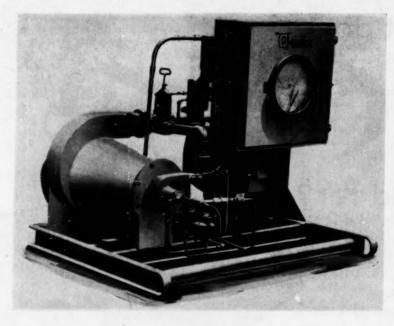
Cradle-mounted pumps ½ through 100 hp — 1 and 2-stage models. Capacities to 3200 gpm—heads to 525 ft. Also available in self-priming models.



Horizontally-split pumps 1½ through 400 hp—1 and 2-stage models. Capacities to 4000 gpm—heads to 1100 ft.



OTHER PUMPS TO 200,000 GPM-PRESSURES TO 6500 PSIG.



DIRECT-FIRED HEATER RUNS COOL WHILE GENERATING 3,000 F. AIR

Burner, mixing tube designs, create blanket of inlet air. Unit is cool enough to touch as it produces hot air for drying, catalyst regeneration.

Heated air, from ambient temperature to 3,000 F., blasts from a direct-fired heater that produces a clean, odorless gas containing no incomplete products of combustion.

Designed so combustion air and process air pass countercurrently around the combustion and mixing zones, the heater uses incoming air as a cooling blanket around the hot parts of the mechanism hence needs no insulation and is barely warm to the touch even when outlet air reaches 3,000 F.

► Zoned Construction—Called "Q-Pak," the unit is divided into zones to permit either once-through or recirculating applications. Fuel gas is burned in a primary zone, then passes directly into a conical secondary zone that is surrounded by the incoming combustion air, flowing countercurrently.

The exit from the wide end of the cone is partially restricted, to cause some of the combustion products to recycle within the cone back to the burner, thus improving combustion efficiency.

Combustion products that pass out of the cone exit are mixed with process air in a primary mixing zone, then pass into another, larger cone that serves as a secondary mixing zone. This cone outlet is also partly restricted, to direct some of the gases back to the primary zone for further mixing; the balance of the heated air passes out of the unit for its end use.

▶ Gases Take Helical Path—Cone design and arrangement insure that gases (both incoming air and combustion products) move through helical paths to facilitate mixing in the various zones. Diverging cone and helical flow pattern produce a vortex at cone exits, which together with a baffle arrangement cause recirculation of the gases within the secondary cones.

► Varied Uses—A direct-fired heater of this nature fits into a

variety of industrial processes, providing heated air for:

Burning the coke from catalyst beads in a catalyst regeneration unit.

 Drying chemical products in ovens, rotary or continuous dryers, or fluidized beds.

• Spray - drying detergents, soap, coffee and other products.

 Drying a variety of materials such as coal, textiles, paper, ceramic materials, plastics, clay, wood chips and fertilizers.

Q-Pak, by its sectionalized design, can also be used for multistage reactor applications. Hot gases from the primary zone can be circulated through a furnace, then reheated in the secondary zone before returning to the furnace.

For chemical reactions, a gaseous reactant can be preheated, then mixed with another reaction material at a required temperature. The unit can also be used to burn waste gases.

► Specifications — Various units are available ranging in capacity from 100,000 to 10,000,000 Btu./hr, handling air flows from 4,650 to 1,082,000 scfh. Standard models produce outlet air temperatures from 200 to 3,000 F., contain automatic proportional recording temperatures controller for temperatures up to 1,000 F. Immediate heated air is produced from a cold start.—Black, Sivalls & Bryson, Inc., Tulsa, Okla.

Flow alarm

Photoelectric instrument protects against high or low gas flow.

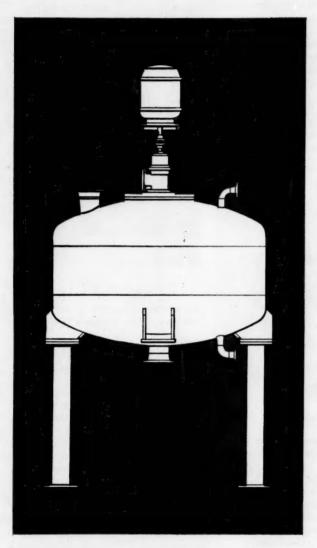
To protect against the hazard of low- or high-level gas flows, this alarm device activates either a warning or purge system. If the flow drops below (or goes above) a predetermined point, which is easily adjusted, a light beam is interrupted; a darkened photoelectric cell triggers the alarm circuit.

Unit can be adapted to all meters ranging from 0-10 through 0-30,000 scfh. Either low- or high-



VAPOR-LIQUID CONTACTOR

A NEW Approach to Vapor-Liquid Contacting for Chemical Industry Application



- Liquid Atomization
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- Enormous Interfacial
 Contact Area
- Positive Single Pass Action
 No Back Mixing
 No Liquid By-Pass
- Liquid Rates to 500 GPM

Where Does This Unit Fit in Your Processing?

Stratford has modified the highly successful STRATCO Vacuum Flash Evaporator to provide a new reaction unit with the many features listed above. The basic method of operation is that of introducing an atomized liquid feed, at extremely high velocities, into a dispersed gas phase. This reactor is particularly useful where extremely fast reactions are involved. It can be constructed for operation at moderately high pressures or under full vacuum.

REPRESENTATIVES

D. D. Foster Co., Pittsburgh, Pa.
D. D. Foster Co., S. Charleston, W. Va.
The Rawson Co., Inc., Baton Rouge
F. J. McConnell Co., New York
Lester Oberholtz, Los Angeles
Rawson-Houlihan Co., Inc., Houston
Rawson-Houlihan Co., Inc., Beaumont, Texas

STRATFORD • PETROLEUM REFINING ENGINEERS
ENGINEERING
CORPORATION

C361

612 West 47th St. Kansas City 12, Mo.

flow warning is possible on all models; but two units are necessary to wire a flow system for low-plus high-flow alarm. Instrument's relays handle 10 amp. at 110 v.—Waukee Engineering Co. Inc., Milwaukee.



Pressure gage
Electrical unit has transducer
to control systems to 2,500 psi.

Designed for air and other gaseous systems, this pressure gage features a small but rugged transducer that responds rapidly to pressure changes, withstands shock and vibration without damage.

Alarm or control of pressure in the range of 0-2,500 psig. is based on thermopile principle. Up to five transducers (which are interchangeable without calibration) can be linked for multipositional gages. Operation is from 115-v., 60-cycle a.c. line.—Hastings-Raydist, Inc., Hampton, Va. 148A



Thermocouple compensator
Unit connects all kinds of thermocouples, compensates the junction.

Based on the ice-bath constanttemperature principle — except that junction temperatures are accurately controlled at 150 F. this device is designed to eliminate the problem of reference junction compensation.

Called the Universal TC Hotbox, the unit joins all types of thermocouple wire directly to copper deep within its heat sink. Since it has no external junctions, there's no need for special wirematching plugs; and all kinds and combinations of thermocouples are accommodated interchangeably.

Junctions are effected quickly by tapered plastic sleeves that wedge each thermocouple wire into a separate heat-sink socket. As many as 51 pairs of wires can be connected, in addition to the pair that leads to the hotbox's temperature monitor.—Research, Inc., Minneapolis. 148B



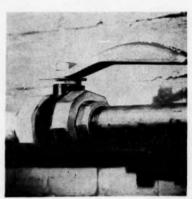
Tubing

Corrosion-resistant piping is Teflon-lined, sleeve-laminated.

Designed primarily to transport corrosive liquids, this tubing also makes a satisfactory bearing or bushing—especially in applications that need self-lubricating,

For More Information about any item in this department, circle its code number on the Reader Service Postcard (Page 251) highly corrosion-resistant tubing. Electrical properties of the Teflon inner wall are said to be unimpaired by aging for 10,000 hr. at elevated temperatures in the presence of hydrofluoric acid. And the laminated Micarta outer shell provides good physical strength.

Inside diameters range from 2 to 12 in., with wall thicknesses from ½ to 1 in. Drawback: maximum length is approximately 2 ft.—Westinghouse Electric Corp., Hampton, S. C. 148C



Union-end ball valve

Easy installation and maintenance
are two of the design's features.

For control of liquid or gaseous flow, this easy-in and easy-fix ball valve has compact one-piece forging, built-in union ends.

Installation takes two steps: screwing or welding the unions to the pipe, and snapping the valve body into the union. In corners or other cramped quarters, the stop plate can be adjusted to position the handle in any of the four quadrants—and the handle can be attached upside down.

The chrome-plated ball itself floats between dual seats, makes an automatic tight seal by being forced against the downstream seat as line pressure increases. At the same time, pressure at the upstream side is equalized by the fluid getting behind the other seat. Hence, low friction is main-

New Equipment continues on page 222



HARD RUBBER-LINED GATE VALVES

FULL PROTECTION AT REASONABLE COST

Corrosive liquids never get near the metal in this longwearing gate valve. All wetted parts are protected by Ace hard rubber, noted for enduring resistance to acids, bleaches, and a host of chemicals. Not just a thin coating, but a thick, homogeneous lining that's calendered layer over layer and applied with permanent bonding techniques to make weak spots impossible.

Precision-machined disc and seat remain drip-tight even after long use. Operation is smooth, low friction. (Wet hard rubber is an excellent bearing material.) Can be packed while open under full pressure. Rated 125 psi. Std. A.S.M.E. flanges. Stocked 2" to 8"; larger sizes to 16" on order.

Ask to see the Ace Gate Valve, and ask its price. It's economical enough to replace many special valves in your

plant...and reliable enough to make highpriced alloy metal valves an unnecessary luxury. Write American Hard Rubber Company today.

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CHEMICAL EQUIPMENT DEPARTMENT

American Hard Rubber Company

ACE ROAD, BUTLER, NEW JERSEY



Rubber-lined steel tanks and special equipment. Also custom compounds for field application Bul. CE-53.



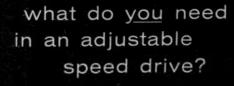
Rubber-lined steel pipe ... combines strength of steel with chemical resistance of Ace Hard Rubber. **Bul. CE-51/52**.



Acid pumps, centrifugal and gear types, protected by Ace Hard Rubber. Full line to 350 gpm. Bul. CE-55.



Hard Rubber pipe and fittings, including heatresistant Tempron for handling hot corrosives. Buls. CE-51/52 and 96.





7½ hp Ajusto-Spede Drive



ing for units up to 71/2 s space or flange-mounted. Larger sizes up to 100 hp with in-dividual motor and drive ousings mounted integrally.

Better Regulation!



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Here's an adjustable speed drive that allows truly precise machine operation. Speed regulation is automatic and stepless - results in faster, more efficient production at lower cost, with less waste, and minimum wear on equipment.

These and other benefits are yours when you use the improved Louis Allis Ajusto-Spede drive. For example, it can be set before or during operation to deliver any desired speed within its range. Its exclusive tachometer feedback circuit monitors the output speed and automatically corrects speed and holds it regardless of load changes.

This improved drive requires minimum maintenance. Its stationary field has no brushes, commutators, or slip rings to cause trouble. The source of power is an equally trouble-free standard a-c squirrel cage motor.

Ajusto-Spede is a registered trademark of the Eaton Mfg. Co.

The cast-iron housing keeps out dirt, chips, and moisture - resists corrosion.

The compact Ajusto-Spede also saves space. Integrallymounted motor and drive simplify handling - can be easily adapted for installation on new or existing machines. Controls can be mounted at the machine or any other convenient position.

The Louis Allis Ajusto-Spede drive is the practical solution to almost every application that requires dependable, easily controlled adjustable speed. It is the answer to precise operating speeds for machine tools, process machinery, test equipment, windups, conveyors, printing presses, and other equipment. Contact your Louis Allis District Office for information and application help. Or write for bulletins 2750 and 2800 - The Louis Allis Co., 447 E. Stewart St. Milwaukee 1, Wis.

How would you conduct these difficult oxidation reactions?

PARTIAL OXIDATION:

Aromatic alcohol to aromatic aldehyde

Organic sulfide to organic sulfoxide

$$CH_3-S-CH_3+? \rightarrow CH_3-S-CH_3$$

SELECTIVE OXIDATION:

Starch or cellulose -- alcohol groups only -to carboxyl groups

Allied Chemical Nitrogen Tetroxide, an abundant source of oxygen, may be the answer to your oxidation problems; it carries approximately 70% oxygen. Under mild conditions, half of this oxygen can be utilized; under more vigorous conditions, the total amount is available.

Nitrogen Tetroxide is a truly low cost oxidizer for reactions typical of those indicated above. It can be used in solutions at very low temperatures, such as NO in N2O4; in concentrated liquid form from -11° to 21° C.; in acids such as sulfuric and nitric; and as a gas in the form of NO2 at elevated temperatures.

With a minimum of N2O4 content of 99.5% and less than 0.1% moisture, Allied Chemical Nitrogen Tetroxide is supplied in tank cars, one-ton, 150- and 125-lb. cylinders.

For application in your operation, write Allied Chemical.

For specifications and local offices, see our insert in Chemical Materials Catalog, page 272A and in Chemical Week Buyers Guide, page 27.

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seal

CONSOLIDATED SAFETY RELIEF VALVE'S Sealing Bellows

protects against damage from contaminants, corrosion, or

viscous fluids

saves



Consolidated Safety Relief Valves are available in both Balanced Bellows and Standard designs. The Standard type has an eductor tube that effectively removes bonnet pressure.

Balanced Bellows Type Consolidated Safety Relief Valves have a durable, two-ply stainless steel Sealing Bellows that isolates and protects working parts from destructive elements in the lading fluid.

The bellows is balanced with the seating surface. Even with superimposed back pressure in the relieving system, valve performance is consistently stable and dependable. The bellows does not affect the high capacity of the valve, nor does it require change in set pressure. Even the blowdown adjustments are limited.

Additionally, Consolidated Safety Relief Valves now offer a no-leak tightness maintained by a resilient "O" Ring Seat Seal retained in the valve disc. This Seal assures tightness at operating pressures far closer to set pressure than with metal-to-metal seats alone, yet does not carry the seat load imposed by the spring. The Seal also takes piping strains much better than all-metal seating.

The Sealing Bellows and "O" Ring Seat Seal are typical of the extra quality built into Consolidated Safety Relief Valves to assure absolute protection for personnel and plant. These fine features plus flat seating and single ring construction also eliminate many maintenance problems and costs. Write for Catalog 1900 and Bulletin 1940.

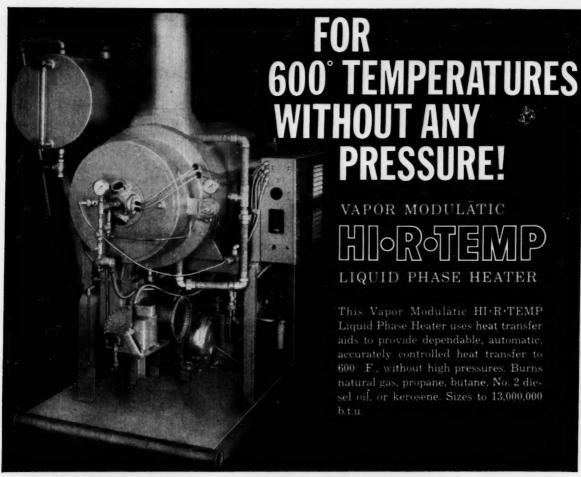


CONSOLIDATED SAFETY RELIEF VALVES

MANNING, MAXWELL & MOORE, INC.

Valve Division . Tulsa, Oklahoma

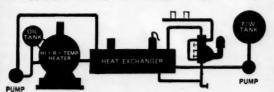
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Heated oil from HI • R • TEMP (at temperatures to 600° F.) passes through heat exchangers to provide steam for processing; at 450° for steam for heating plant and office; at 200° for hot water for cleaning, washing, other uses. Provides full, economical use of heat to lower your operating costs!



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Wagner[®] Silicone Rubber Insulated Motors

Power-packed drip-proof polyphase motors that are exceptionally moisture-resistant... save you money in lower initial equipment cost for many applications

These are motors that are built to take on and tame the toughest jobs. Big, job-rated motors, available in frames larger than 445U, through 1000 horsepower. Perfect drives that can be used for station auxiliaries, in chemical plants, in rubber and paper mills and in the petroleum industry.

With motor coils completely sealed in a jacket of silicone rubber and housed in a compact, drip-proof enclosure, these Wagner® motors are suitable for use in highly humid atmospheres. They perform perfectly even after long exposure, and at elevated temperatures. Since moisture does not penetrate their tough silicone jackets, they are now used for many installations that once required totally-enclosed motors. Silicone rubber insulated motors cost less

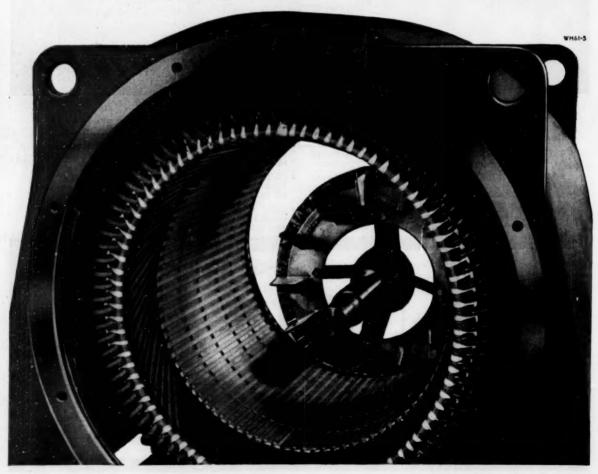
to buy than equivalent totally-enclosed fan cooled motors, since there is no need for expensive enclosures.

But your savings don't stop with initial cost. When rated to match normal load, Wagner silicone rubber insulated motors deliver rated horsepower at top efficiency. They have more overload capacity for temporary overloads...reduce downtime while they help keep production levels up.

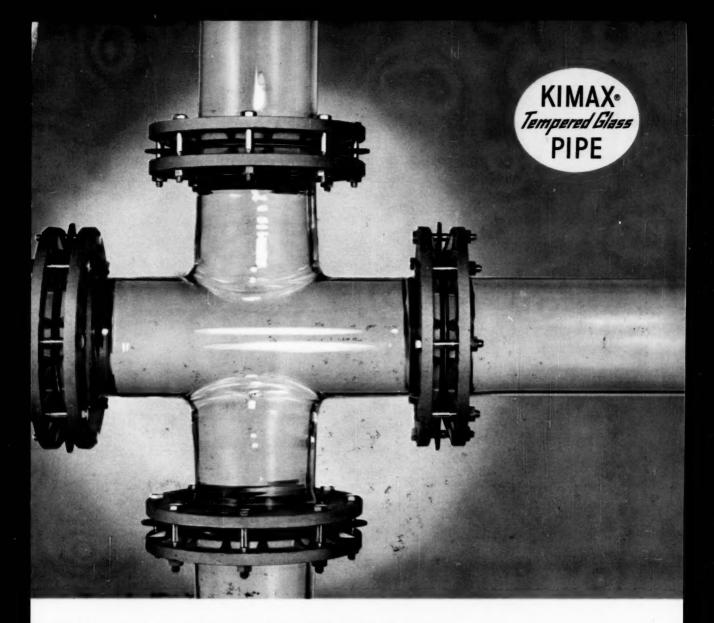
Like to hear the whole money-saving story of these dependable Wagner silicone rubber insulated motors? Call your Wagner Sales Engineer...then settle back for some profitable listening.

Wasner Electric Corporation

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April 17, 1961-CHEMICAL ENGINEERING



Your product stays pure... because KIMAX resists corrosion!

Do your present process pipe lines guarantee the purity of your product? If not, consider KIMAX Tempered Glass Pipe.

It resists corrosion and pitting tiny particles cannot lodge. Smooth inner walls discourage build-up of scale and residue.

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KIMAX Glass Pipe is serenely indifferent to the savage attack of most acids and alkalis.

Since glass is inert, nothing is ever added to or taken away from your basic product.

Stoppages in the line can be spotted in seconds and remedied

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And KIMAX Glass Pipe is economical . . . initial costs compare favorably with other pipe materials. Installation cost is usually less and maintenance cost is practically nil.

For more information about KIMAX Glass Pipe write Kimble Glass Company, a subsidiary of Owens-Illinois, Toledo 1, Ohio.

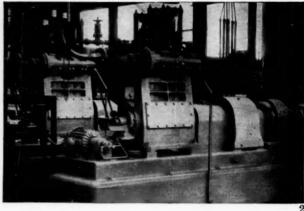
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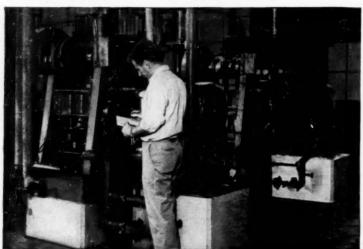
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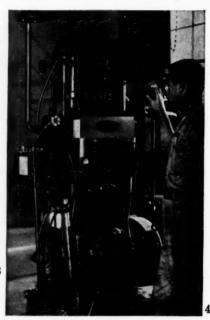
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For example: in installation #1 above, an Aldrich pump with stainless steel fluid-

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Aldrich Pumps range from 25 to 2500 hp.; pressures to 50,000 psi. For additional information, see our insert in Chemical Engineering Catalog. For complete data, or help on a specific problem, write Aldrich Pump Company, 3 Gordon Street, Allentown, Penna.

THE TOUGH PUMPING PROBLEMS GO TO



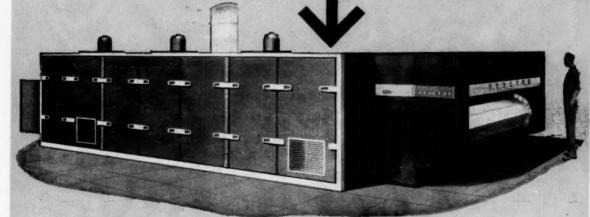
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introduces the "Newest Dryer Under the Sun"

Proctor's new, completely redesigned, single conveyor dryer . . . the S C L . . . promises a new day for drying . . . superior performance . . . at a new low investment!

Profit from these advanced SCL features:

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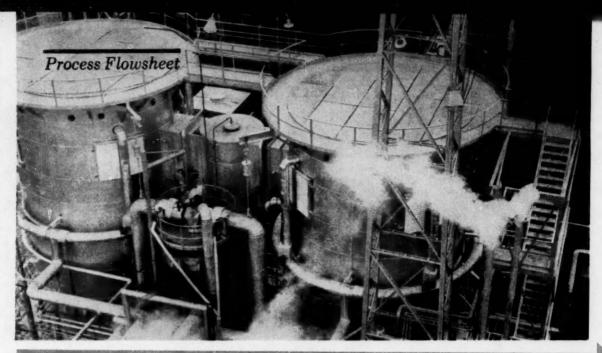
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Unfold flowsheet

Methane Reforming: Pressure Goes Up

French plant produces ammonia synthesis gas at 250 psi., provides new case-in-point for proponents of high-pressure reforming.

N. P. CHOPEY, Assistant Editor

A 200-metric-ton/day ammonia plant at Tolouse, France, is making news in more ways than one.

On stream since last fall, it represents the latest step in chemical exploitation of that country's vast natural-gas fields at Lacq. But the installation is noteworthy from a process standpoint, too: its synthesis gas unit reforms methane at about 250 psig., which is believed to be the highest pressure in use at any plant of this type in the world.

The synthesis gas plant was designed for France's Office National Industriel de L'Azote (ONIA) by Chemical Construction Corp., New York. It embodies Chemico's conviction that, in general, the process advantages of reforming at high pressure outweigh the drawbacks incurred in equipment design and in bucking the dictates of reaction equilibrium theory.

Purpose of the methane reforming unit is to produce hydrogen, for use in ammonia synthesis at high pressure, through the over-all reaction:

 $CH_4 + 2H_2O \rightarrow CO_2 + 4H_2$

Chemico's design of plants to carry out this process has shown a steady trend toward higher pressures during the past several years, rising from a level of 1 atm. around 1953.

► Why High Pressure?—Russ James, chief engineer of the New York firm's Industrial Products Dept., stresses three advantages while outlining the case for high-pressure reforming:

1. Feed gases for ammonia synthesis must be compressed before they enter the ammonia reactor. Since the methane reforming reaction is a net producer of moles of gas, an increase in the fraction of total compression that takes place ahead of the reforming step lowers the over-all amount of compressor horsepower needed.

2. Reforming is carried out with an excess of steam, which is recovered downstream as condensate. The higher the operating pressure, the higher will be the value of this condensate as a heat source.

3. High-pressure design generally leads to smaller equipment and piping for the facility.

 Reformer portion of plant includes two primary furnaces, background, plus single secondary unit in foreground.

James further points out that natural-gas feed to reforming is usually available at high pressure in the first place and that operating at elevated pressure lowers the amount of reforming catalyst needed.

On the other hand, pressure increase adversely affects equilibrium in the reforming reaction; accordingly, as Chemico has gone to higher pressures, it has also had to increase the reforming temperature. Too, use of high pressure causes problems during mechanical design of reforming furnaces. And, James points out that the benefits of higher pressures are subject to the law of diminishing returns.

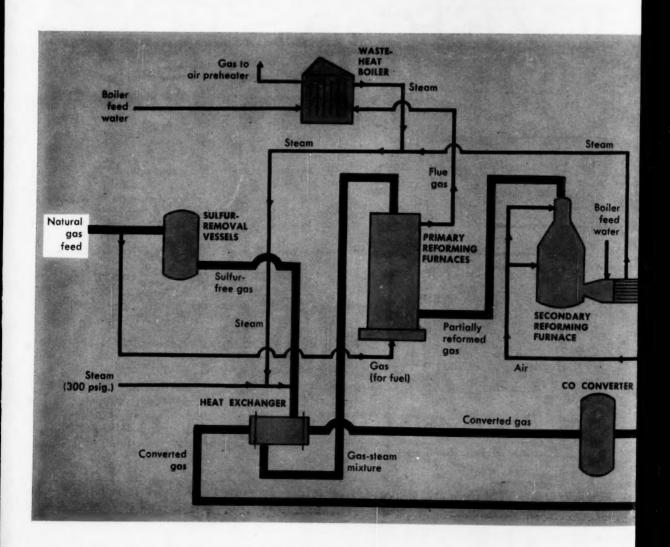
► At Tolouse—The new ONIA plant is some 100 mi. from the gas fields around Lacq. Built primarily to process output from these fields, it can

also treat natural gas from other sources. Process flow through the unit follows in general the conventional sequence for synthesis gas preparation but incorporates some Chemico features, especially in heat recovery and CO₂ removal.

Natural-gas feed to the plant is around 275 psig. Part of the stream goes directly to the primary reforming furnaces to serve as fuel; the rest passes through vessels containing activated carbon, which adsorbs sulfur compounds. (Sulfur content of the effluent is about 1½ ppm.) Gas next combines with steam and the mixture is preheated to 700–800 F. It is then ready to enter the primary reforming furnaces.

PReform, Convert—In these furnaces, feed passes downward through tubes containing conventional nickel catalyst, exits at about 1,300 F. with methane content around 8%. Flue gas goes to a waste heat boiler and an air heater.

Partially reformed gas enters the secondary



sources. Process general the congas preparation features, espeemoval.

t is around 275 directly to the rive as fuel; the sining activated bounds. (Sulfur 1½ ppm.) Gas mixture is predy to enter the

furnaces, feed containing conabout 1,300 F. Flue gas goes r heater.

the secondary

reformer, which contains two beds of catalyst. Preheated air at 700-800 F. and roughly 250 psig. is combined in two steps with the gas, to furnish proper ratio of hydrogen to nitrogen in the final stream to the ammonia reactor. Temperature in this reformer ranges from 1,600 to 1,800 F., and the gas leaves with methane content of 0.2%.

A waste heat boiler and a heater for air to the reformer recover heat from the product stream. Then, at about 800 F., the gas goes to a CO converter containing chromium-promoted iron oxide catalyst. Converter product exits around 850 F., contains some 3% residual CO.

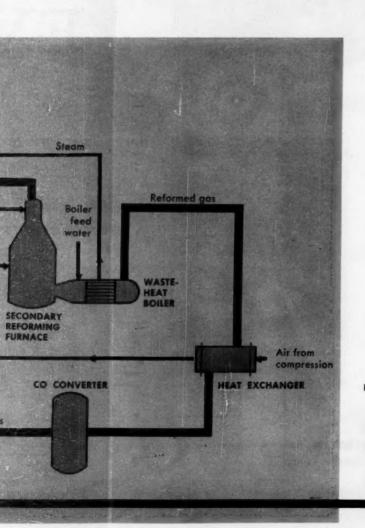
Gas stream then cools in three successive steps: heat exchange with entering feed, passage through a reboiler in the CO₂-removal section of the plant and heat exchange with a process water stream. Finally, it goes to a knock-out drum where the excess steam is recovered as condensate at about 250 F.

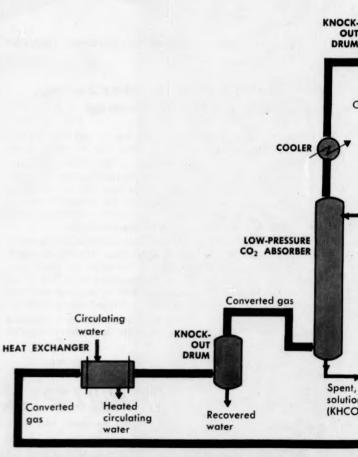
▶ Take Out CO₂—ONIA uses a potassium carbonate system for CO₂ removal, and Chemico included two absorption steps in the plant design.

Converted gas coming from the knock-out drum first enters a low-pressure absorption tower that operates at about 200 psig. This vessel and the subsequent, high-pressure tower contain packing; in both, the gas rises countercurrent to potassium carbonate solution. As the solution absorbs CO₂, part of the carbonate becomes potassium bicarbonate.

Low-pressure tower reduces CO₂ content of the gas to about 3%. Process stream leaving the tower is cooled, then compressed to 750–800 psig. after removal of condensates. It then enters the high-pressure absorber, which lowers CO₂ content to about 0.9%. This relatively high level is required by ONIA in downstream processing after the stream leaves the synthesis gas plant.

After cooling, the gas is ready for final com-





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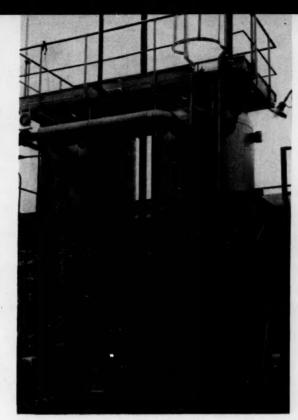
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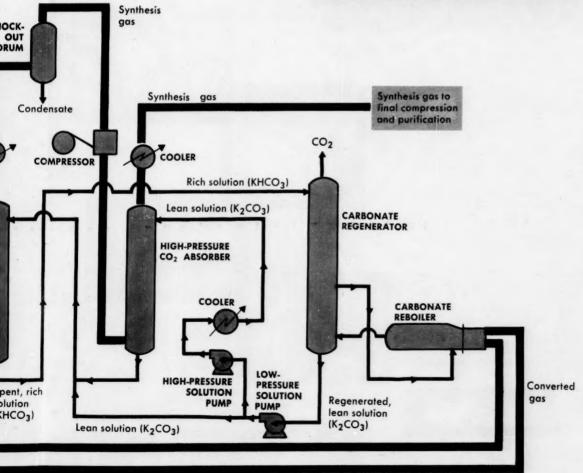
Clea

pression and purification before going to the ammonia synthesis reactor. Final compression is accomplished in two stages; thus the ONIA plant includes only three compression steps for the process stream after it leaves the reformer—in contrast with a requirement of six steps for Chemico's atmospheric-pressure designs of around 1953.

Spent solution from the absorbers is reactivated in a regeneration tower, where heat drives off CO₂ and returns the solution to its carbonate state. Carbonate solution goes to a pump; about 80% of the pump discharge goes to the low-pressure absorber and the rest passes through a second pump to the high-pressure unit. Solution leaving the latter tower enters the low-pressure vessel.

Cleanup of natural gas feed takes place in activated-carbon adsorbers that reduce sulfur content to about 1½ ppm.





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One of the mill stock bays

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- You can get a complete process piping package

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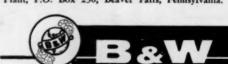
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April 17, 1961—CHEMICAL ENGINEERING

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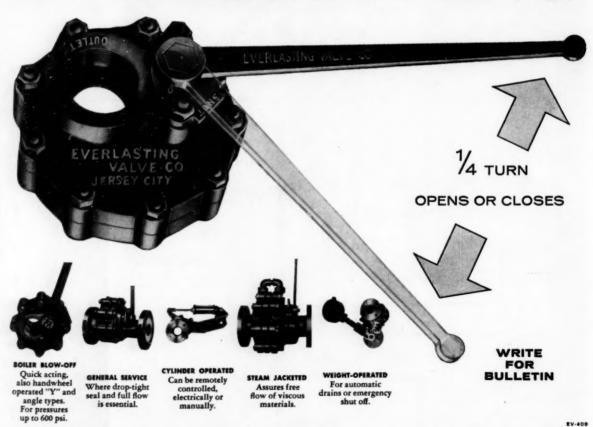
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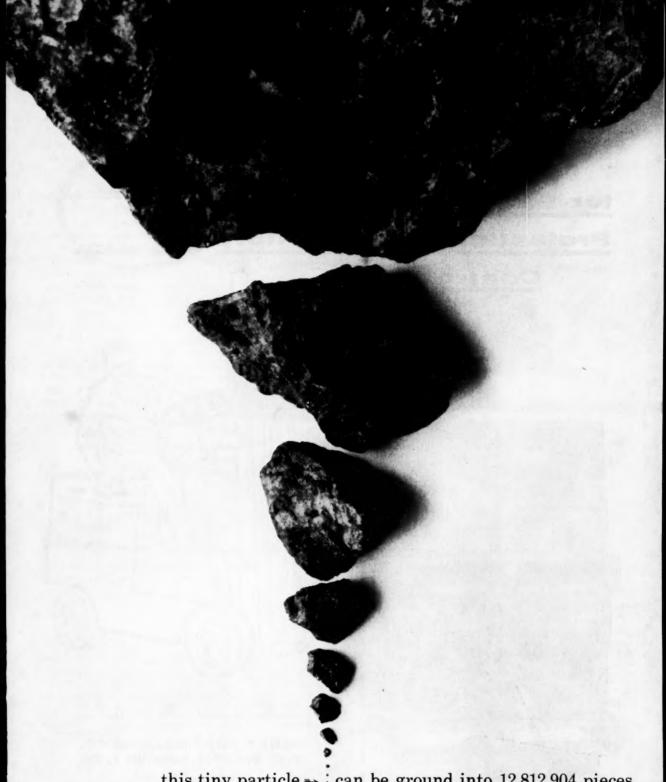
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In the special 10-page tabulation that follows, you will find over 500 chemical process industry projects that have been in the news in the U.S. during the period from August 1960 through January 1961. Included are announcements of plans, construction starts and project completions as covered in published sources.

This is the 12th in *Chemical Engineering's* long series of such reports, and the second to be issued on a new, accelerated six-month schedule.

Listings have been compiled from many sources and have, so far as feasible, been checked for accuracy, completeness and current status. Included are major projects only (\$200,000 or more).

Previous tabulations, which will provide information on projects earlier than those covered here, appeared in the February issues of 1951, 1952 and 1953; in January 1954; in our Inventory issues of 1955, 1956, 1957; in regular issues of May 4, 1959, April 18, 1960, and Oct. 17, 1960.



Semiannual Inventory of New Plants & Facilities

Fertilizers				
Company	Location	Products	Capacity	Status and Remarks
American Cyanamid Co	Brewster, Fla	Phosphoric acid, triple superphosphate	400,000 tons/yr.	Planned, expanded capacity will double output. Project will cost \$10-million.
Armour & Co	Fort Meade, Fla	Phosphate products, sulfurie acid	700,000-800,000 tons/yr. ore	Planned Fort Meade plant, plus a nitro- gen-products plant to be built at Sheffield, Ala., will cost \$60-million.
Armour & Co	Sheffield, Ala	Ammonia Nitric acid	360 tons/day 300 tons/day	Plant planned. Includes 240 tons/day N solutions and 250 tons/day ammo- nium nitrate.
California Chemical Co	Fort Madison, Iowa	Ammonia	360 tons/day	\$22-million contract awarded for con-
California Chemical Co	Kennewick, Wash	Ammonium nitrate, nitric acid Mono- and diammon. phos Dry complex fertilizers	200 tons/day 300 tons/day	struction. Due on stream late 1961. \$5-million plant on stream.
Collier Carbon & Chemical Corp Consumers Cooperative	Kellogg, Idaho Lawrence, Kan	Anhydrous liquid phosphate. AmmoniaUrea.	100 tons/day 40 tons/day	Due on stream early 1961. Capacity increase due completed by end of 1960.
Cooperative Farm Chemicals Assn. Olin-Mathieson Chemical Corp	Lawrence, Kan	Urea Fertiliser	300 tons/day 500,000 tons/yr.	Installed capacity now being expanded. \$1.5-million expansion planned.
Shell Chemical Co	Ventura. Calif Dominguez, Calif	Urea Fertilizers	50,000 tons/yr.	Expansion due on stream early in 1961. Plant due completed early 1961.
Southern Nitrogen Co	Savannah, Ga	Nitrogen products		\$1.3-million expansion under way, includes: (1) 33,000-ton/yr. nitric acid plant; (2) new concentrating facilities for ammonium nitrate solution; (3) increase in liquid-ures capacity from 10.000 to 17.000 tons/yr.
Southwest Potash Co	Vicksburg, Miss	Potassium nitrate	***********	\$7-million plant on stream Oct. 1961; new process promises low operating costs, economical fertilizer product.
Stauffer Chemical Co Tennessee Corp	Vernal, Utah Tampa, Fla	Phosphate fertilizers	***************************************	Plant planned. Multimillion-dollar program to increase company's capacity at Tampa by 50%; due late 1961 or early 1962.
Tenneasee Corp	Tampa, Fla	Ammonia	350 tons/day	\$11-million plant under construction; completion late 1961 or early 1962.
Virginia-Carolina Chemical Corp.	Nichols, Fla	Concentrated superphosphate Diammonium phosphate	300,000 tons/yr. 100,000 tons/yr.	\$10-million plant due on stream Dec.

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Company	Location	Products	Capacity	Status and Remarks
Air Products, Inc	Cleveland, Ohio	Oxygen	570 tons/day	\$10-million facility due completed Feb. 1961. Most of output will go to Jones & Laughlin steel furnaces.
Air Products, Inc	Hopewell, Va	Hydrogen	18 MM cf./month	\$6-million plant officially dedicated. On stream; product is 99.9% pure.
Air Products, Inc.	Newark, N. J			Due on stream by end of 1960. Due on stream early 1961.
Air Reduction Co	Tampa, Fla			Due on stream early 1961.
Air Reduction Pacific Co	Richmond, Calif	Oxygen, nitrogen, argon	65 tons/day	Expanded capacity under construction will increase output 20%.
Air Reduction Sales Co				Expanded capacity under \$5.5-million program will triple output.
Allied Chemical Corp		Gypsum		Construction under way; gypsum is by- product of wet-process phosphoric.
Allied Chemical Corp	East St. Louis, Ill	75% orthophosphoric acid Chlorine, caustic soda	50,000 tons/yr. 20,000 tons/yr.	Planned capacity increase. Plant planned. Due early 1961. Capacity increase due completed 1961; will bring plant's chlorine capacity to about 80,000 tons/yr.
American Cyanamid Co		Sulfuric acid		Plant planned. Capacity on stream expanded 50%.
American Potash & Chemical Corp. American Potash & Chemical Corp.	Aberdeen, Miss	Sodium chlorate		Modernization completed.
American Potash & Chemical Corp.	Trona, Calif	Potash		25% expansion in capacity is under way
American Potash & Chemical Corp. and Laporte Industries Ltd.		Titanium dioxide		Plant, costing about \$15 million, due on stream 2nd half 1962.
Arkansas Chemicals, Inc	El Dorado, Ark	Bromine		New company formed jointly by Hous- ton Chemical Corp. and Great Lakes Chemical Corp., due early 1961.
Big Three Welding Equipment Co.	Orange, Tex	Gaseous nitrogen	17 tons/day	Plant planned.
Blockson Chemical Co	Joliet, Ill	Liquid oxygen		\$1.5-million expansion under way; due
Bonneville, Ltd	Wendover, Utah	Potash		completed April 1961. Dredging contract awarded for 4,300-
Buckeye Cellulose Corp	Foley, Fla	Chlorine dioxide	6 tons/day	acre evaporation pond. Expanded plant on stream.
Bunker Hill Chemical Co	Kellogg, Idaho	Phosphoric acid		On stream.
Chemetron Corp	Gibbstown, N. J	Carbon dioxide		On stream; liquid and solid product.
Chemical Lime, Inc		Lime Sulfurie acid	250 tons/day	\$2-million plant due summer 1961. Construction completed.
Columbia-Southern Chemical Corp.	Corpus Christi, Tex	Chrome chemicals.,		Multimillion-dollar project planned.
Dixon Chemical & Research, Inc.		Hydrofluoric acid	10,000 tons/yr.	Under construction,
E. L. duPont de Nemours & Co	Wurtland, Ky	Sulfuric acid		Multimillion-dollar expansion planned, due on stream 1961.
Ford Motor Co	Dearborn, Mich	Gaseous oxygen Liquid oxygen Liquid nitrogen	10 tons/day	Contract awarded for engineering and construction. Due on stream Dec. 1961.
Hercules Powder Co	Hercules, Calif	Nitrogen tetroxide		Quadrupling capacity.
Hooker Chemical Corp	Columbus, Miss	Sodium chlorate		Expansion due completed by early 1961. Plant on stream.
International Salt Co	Avery Island, La	Pure salt	15 tons/hr.	On stream; uses new purification.
Kaiser Aluminum & Chemical Corp.	Baton Rouge, La	Active alumina	*****************	\$700,000 expansion due completed 2nd quarter 1961; will boost firm's active- alumina capacity fivefold.
Kaiser Aluminum & Chemical Corp.	Gramercy, La	Aluminum fluoride		Construction on \$1.4-million facility will start mid-1961, be finished 3rd quarter
Linde Co. (Union Carbide)	Ecorse, Mich	Oxygen		of 1962. Plant on stream at Great Lakes Steel.
Linde Co. (Union Carbide)	Fontana, Calif	Liquid hydrogen		Due completed by June 1962, output will go to NASA.
Linde Co. (Union Carbide) Linde Co. (Union Carbide)	Houston, Tex	Oxygen	500-1,000 tpd.	Plant planned to supply Armco Steel. Estimated \$5-million plant planned to
Linde Co. (Union Carbide)	Huntsville, Ala	Nitrogen Liquid nitrogen		serve customers via pipeline. Under construction.
Linde Co. (Union Carbide)		Oxygen		Now under construction; to supply nearby Union Carbide Chemicals
Linde Co (Union Carbida)	Nasaha Ma	Liquid oxygen, liquid nitrogen	140 tone/dest	ethylene oxide plant. Plant on stream.
Linde Co. (Union Carbide) Linde Co. (Union Carbide)	Pueblo, Colo	Oxygen	Over 200 MM cf./	Will supply Colorado Fuel & Iron Corp.'s steel mill.
Linde Co. (Union Carbide)	Torrance, Calif	Liquid hydrogen	6.5 tons/day	Has reached full-scale operation.
Michigan Chemical Co	El Dorado, Ark	Bromine	10 MM lb./yr.	Expanded capacity on stream.
Michigan Chemical Co	Port St. Joe, Fla	Magnesia Vanadium pentoxide	1.5 MM lb./yr.	Expansion under way. Due on stream April 1961; will use
Susquehanna-Western, Inc. Monsanto Chemical Co	El Dorado, Ark	Sulfur	15 tons/day	phosphorus slag as feedstock. On stream; recovery unit.
Monsanto Chemical Co New Jersey Zinc Co	Everett, Mass	Sodium bisulfite	46,000 tons/yr.	Expanded facilities on stream. Expanded capacity due completed 1961
North American Coal Corp	Powhatan, Ohio.	Alum		will double output. Due completed July 1961; will produce
Olin-Mathieson Chemical Corp	Beaumont, Tex	Sulfur dioxide		alum from coal-mine waste. On stream; recovers SO ₂ from off-gases
			360 tons/day	at sulfuric acid plant.
	Charleston, Tenn	Chlorine, caustic soda Phosphoric acid (75%) Calcium hypochlorite	50,000 tons/yr.	\$13-million project due late 1961. \$1.5-million facility due May 1961. Expansion program, due completed Dec. 1961, will double capacity.
Pennsalt Chemicals Corp	Wyandotte, Mich	Chlorine, caustic soda Barium chemicals		\$6-million modernization completed. Due on stream late 1962.
Pittaburgh Plate Glass Co	New Martinsville, W. Vil	Danum coemicals	*******	Due on stream mae 1902.

Inorganics—Continued _____

Company	Location	Products	Capacity	Status and Remarks
Publicker Industries, Inc	Philadelphia, Pa	Carbon dioxide	•••••	Planned \$5-million facility will separate CO ₂ from flue gases at steam plant, for liquid and solid product.
Solar Nitrogen Chemical, Inc	Joplin, Mo	Urea, ammonia, related prod- ucts		\$2-3-million plant due completed Oct. 1961; Dutch State Mines process.
Southwest Potash Corp	Carlsbad, N. M	Potassium chloride		\$3-million plant being built.
Stauffer Chemical Co	Baton Rouge, La	Liquid sulfur dioxide	10,000 tons/yr.	Due completed Nov. 1960.
Stauffer Chemical Co	Counce, Tenn	Liquid alum		Due on stream Feb. 1, 1961.
Stauffer Chemical Co	Green River, Wyo	Soda ash	150,000-200,000 tons/yr.	\$20-million construction started; due on stream late 1962.
Stauffer Chemical Co	Weston, Mich	Titanium trichloride	500,000 lb./yr.	On stream.
Stauffer Chemical Co	Wilmington, Calif	Chlorine, caustic soda		Engineering under way.
Swift & Co	Bartow, Fla	Phosphoric acid	175,000 tons/yr.	Expanded capacity due on stream May 1961 will double output.
Texas Gulf Sulphur Co	Moab, Utah	Potassium chloride	Over 1 MM tons/	\$20-30-million facility under construc- tion.
Tidewater Oil Co., Texaco, Inc., others	Mount Vernon, Tex	Sulfur	220 tons/day	On stream, recovery from natural gas.
Trans-Jett Chemical Corp	Tilden, Tex	Sulfur	20 tons/day	Recovery in sweetening sour gas.
Union Carbide Metals Co	Sheffield, Ala	Calcium carbide	60,000 tons/vr.	On stream; formerly a ferro-alloy unit.
U. S. Borax & Chemical Corp	Carlsbad, N. M	Potassium chloride		Facilities due on stream early 1961 will up product purity from 99.7 to 99.9%.
U. S. Gypsum Co	New Orleans, La	Lime		On stream; clam shells used as feedstock.
U. S. Industrial Chemicals Co	Tuscola, Ill.	Ammonia		Expanded capacity completed.
Virginia Smelting Co	West Norfolk, Va	Liquid sulfur dioxide		Expansion on stream.
West End Chemical Co	Westend, Calif	Sodium sulfate		Expansion on stream by summer 1961; will boost capacity to 200,000 tons/yr.
West Texas Carbon Dioxide Co	Fort Stocktor, Tex	Liquid CO2	140 tons/day	\$500,000 plant due on stream fall 1960.
Wyandotte Chemicals Corp	Wyandotte, Mich	Lime		Expansion due on stream 1961.
Wyandotte Chemicals Corp. and Peerless Oil & Chemical Corp.	Puerto Rico	Chlorine, caustic soda		\$2-million plant due on stream by 1962.

Metals _____

Company	Location	Products	Capacity	Status and Remarks
American Potash & Chemical Corp.	Aberdeen, Miss	Manganese	10 MM lb./yr.	\$5-million plant due on stream late 1961.
American Potash & Chemical Corp.	Trona, Calif	Boron		Expansion will boost capacity 35% in 3rd quarter of 1961.
The Anaconda Co	Anaconda, Mont	Copper	*************	\$6-million smelter modernization, due for completion in 1961.
Bethlehem Steel Co	Los Angeles, Calif	Iron		Experimental unit, under construction.
Beryllium Resources	Topaz Mt., Utah	Beryllium concentrate	*****************	Plans to start construction, by mid-1961, of mill to recover beryllium from 0.1-3.0% BeO ore.
Brush Beryllium Co	Cleveland, Ohio	Beryllium	***************************************	\$3-million office and factory building planned to consolidate operations.
Brush Beryllium Co	Toledo, Ohio	Beryllium		\$6-million expansion program due for completion July 1961.
E. I. duPont de Nemours & Co	Baltimore, Md	Refractory metals		\$10-million facility to be in full operation by spring 1961.
Florida Steel Corp	Charlotte, N. C	Steel	51,000 tons/yr.	\$3.3-million plant due mid-1961.
Foote Mineral Co	New Johnsonville, Tenn	Manganese	20 MM lb./yr.	\$6-million plant planned; first stage (10 MM lb./yr. capacity) due late 1961.
General Electric Co	Cleveland, Ohio	Refractory metals		\$15-million construction started.
W. R. Grace & Co	Erwin, Tenn	High-purity U-233		Expansion, installing remote-control instrumentation; product is for epithermal thorium reactor being built by Southwest Atomic Energy Assn. at Canoga Park, Calif.
Harvey Aluminum	The Dalles, Ore	Primary aluminum	75,000 tons/yr.	Expanded capacity under construction.
Harvey Aluminum	Pacific Northwest	Primary aluminum Iron-ore concentrate		New plant planned. \$15-million plant on stream.
Kaiser Aluminum & Chemical	Chalmette, La	Aluminum billets	· · · · · · · · · · · · · · · · · · ·	\$2-million expansion planned.
Metal Carbides	Murfreesboro, Tenn	Tungsten carbide		On stream fall 1961. Metal Carbides leasing plant built by local capital.
Lone Star Steel Co	Dangerfield, Tex	Steel		Pian to use Strategic-Udy process.
Mineral Concentrate & Chemical Co.		Beryllium oxide		Plant due on stream by March 1961; raw material is low-grade beryl ore.
Pyron Co Sovereign Steel of Texas	Niagara Falls, N. Y	Powdered iron		\$1.5-million plant under construction. Plant due on stream early 1962; will use
Bovereign Steel of Texas	Talestine, Tex	Steel	1,000 tons/day	Strategic-Udy process.
Strategic Materials Corp	Niagara Falls, N. Y	Stainless steel		\$1.5-million plant under construction; will treat hitherto-unusable lateritic and chromitic ores.
Sylvania Electric Products	Towanda, Pa	Tungsten, molybdenum sintered products		Expansion due for completion late 1960.
Temescal Metallurgical Corp	Berkeley, Calif	Refractory metals:		New plant features an electron-beam furnace, called the largest ever built.
Union Carbide Metals Co	Marietta, Ohio	Manganese	*************	20% expansion of firm's capacity com- pleted.
United Pacific Aluminum Corp	Longview, Wash	Primary aluminum	45,000 tons/yr.	\$10-million pig-aluminum plant planned.
Vulcan Materials	Houston, Tex	Tin, steel scrap		Due completed early 1961.
Vulcan Materials	Los Angeles, Calif	Tin, steel scrap	350,000 tons/yr.	Due completed 1961. Due on stream 1962.
Webb & Knapp and Strategic Materials Corp.	Butte, Mont	Low-carbon steel		\$40-million plant planned, will use discarded slag as raw material.
Westinghouse Electric Corp	Youngwood, Pa	Silicon, germanium		On stream with 200% expansion.

Organics -

Organics —	* 41	Dec desets	Commelton	Status and Damasha
Company	Location	Products	Capacity	Status and Remarks
Allied Chemical Corp	***************************************	Melamine crystal	. Over 20 MM lb./ yr.	in N. America to use urea as raw material. Site undisclosed.
Allied Chemical Corp				Plant due completed early 1961.
Allied Chemical Corp			50 MM lb./yr. 140 MM lb./yr.	On stream. Expanded capacity due completed mid- 1961, will up output 75%.
Allied Chemical Corp			25 MM lb./yr.	New plant planned. Expansion planned; will raise plant capacity by about 40%.
Allied Chemical Corp	Moundaville, W. Va		100 MM lb./yr.	Expanded capacity due June 1961. Expansion due on stream early 1961. \$1-million replacement and expansion for facilities destroyed by fire.
Amoco Chemicals Corp	North Tonawanda, N. Y	Isophthalic acid Dimethyl terephthalate Benzene Naphthalene	60 MM lb./yr. 24 MM lb./yr. 7 MM gal./yr. 75 MM lb./yr.	Undergoing start-up. Expanded capacity due Sept. 1961. Expanded capacity due on stream 1961. On stream.
Atlantic Refining Co. and Pure Oil Co.	Nederland, Tex	Benzene, toluene, xylenes		Startup scheduled for late 1961.
Baxter Laboratories	Kingstree, S. C	Pharmaceuticals		Construction started.
Bzura Chemical Co	Fieldsboro, N. J	Citrie acid	12 MM lb./yr.	\$2.5-million plant on stream. \$1.4-million plant completed.
California Chemical Co	Richmond, Calif	Ortho-Xylene		\$17-million plant due completed late 1961 or early 1962.
Carwin Co	Houston, Tex	Isocyanates		\$1-million plant due on stream shortly.
Celanese Corp. of America	Bay City, Tex	Petrochemicals		Multimillion-dollar project planned. Expanded capacity due early 1961.
Celanese Corp. of America	Pampa, Tex	Higher acrylate esters		Multimillion-dollar expansion due late 1960, doubling acrylate capacity.
Chemetron Corp	Newport, Tenn	Sodium xylenesulfonate		Plant on stream.
Cities Service	Lake Charles, La	Ortho-Xylene		Due on stream 1961. Claimed largest plant built specifically for o-xylene.
Columbia Gas	Siloam, Ky	Ethylene	200 MM lb./yr.	Plant planned; capacity unconfirmed.
Continental Oil Co	Lake Charles, La	Straight-chain alcohols Cycloparaffins		Plant due completed 1961. Under construction; will use UOP's Hydrar process. Due completed mid- 1961.
Continental Oil Co	Ponea City, Okla	CyclohexaneButadiene	20 MM gal./yr. 55,000 tons/yr.	\$1-million plant on stream. Expansion due on stream July 1961.
	Big Spring, Tex	Styrene	70 MM lb./yr.	Expanded capacity due completed Nov. 1960.
Crown Central Petroleum	Houston, Tex	Bensene	4 MM gal./yr. 10 MM gal./yr.	Udex recovery from catalytic reformer stream. Construction schedule in-
Crown Zellerbach Corp	Bogalusa, La	Xylenes. Dimethyl sulfide. Dimethyl sulfoxide.	12 MM gal./yr. 10 MM lb./yr.	definite, capacities unconfirmed. On stream; recovers chemicals from kraft black liquor.
	Belle, W. Va	Methyl mercaptan Chlorinated products	1 MM lb./yr.	\$1-million long-range expansion planned.
Diamond Alkali Co Dow Badische Chemical Co	Deer Park, Tex	n-Butanol, isobutanol	35 MM lb./yr.	Due on stream 1961; capacity uncon- firmed.
Dow Chemical Co		Styrene	200 MM lb./ут.	Due on stream early 1961. Estimated capacity increase under con- struction at Midland, Mich. and/or Freeport, Tex.
	Freeport, Tex	PolyglycolsPhenol	36 MM lb./yr.	Expansion planned. Due on stream late 1961; toluene feed- stock.
	Plaquemine, La	Vinyl chloride monomer		Expansion planned.
	Beaumont, Tex	Acrylonitrile	50 MM lb./yr. 35-40 MM lb./yr.	Construction started. Expanded capacity due early 1961.
E. I. duPont de Nemours & Co	Memphis, Tenn	Acrylonitrile	50 MM lb./yr.	On stream.
	Niagara Falls, N. Y	Trichloroethylene	****************	Will consolidated all Du Pont trichloro- ethylene production at Niagara Falls.
	Orange, Tex., and Belle, W. Va.	Methanol		Expansion at the two plants will increase Du Pont methanol capacity by 35%.
D X Sunray Oil Co	Tulsa, Okla	Benzene	9 MM gal./yr. 5 MM gal./yr.	Udex unit, recently completed. Most of toluene will be fed to a Hydeal unit now under construction.
El Paso Natural Gas Co	Odessa, Tex	Olefins		Multimillion-dollar contracts awarded; joint venture with Rexall Chemical;
El Paso Natural Gas Co	Odessa, Tex	Styrene	80 MM lb./yr.	output for new Rexall plant. Expanded capacity due completed late 1960; will add 20 MM lb./yr. capacity
Emery Industries	Cincinnati, Ohio	Pelargonic and aselaic acids	*************	UOP Alkar unit. \$6-million plant due on stream by June
Ethyl Corp	Houston, Tex	Vinyl chloride monomer	50 MM lb./yr.	1961; ozone will split oleic acid. Under construction; capacity unconfirmed.
	New Johnsonville, Tenn Baton Rouge, La	Butyl lithium	100,000 lb./yr. 150 MM lb./yr.	firmed. Construction started. Estimate of expanded capacity planned.
Manne Weller	Fords N. J	Styrene Phthalic anhydride	100 MIN 10./ yr.	Under construction.
			12 MM gal./yr.	
W. R. Grace & Co	Philadelphia, Pa	Bensene	12 MINI ROLLY YI.	Planned capacity increase.
W. R. Grace & Co	Philadelphia, Pa	Methanol	8 MM gal./yr. 50 MM lb./yr. 11,000 tons/yr.	Multimillion-dollar project on stream; methanol plant is first one on West Coast.

Organics -Continued _

Burnen				
Company	Location	Products	Capacity	Status and Remarks
Gulf Oil Corp	. Philadelphia, Pa	. Oxo-alcohols	. 40 MM lb./yr.	\$10-million projects nearly completed.
Heyden Newport Chemical Corp	. Fords, N. J			. Units on stream, doubling capacity.
Heyden Newport Chemical Corp		Maleic anhydride	24 MM lb./yr.	Due on stream by May 1961.
Heyden Newport Chemical Corp Heyden Newport Chemical Corp				Construction due completed Feb. 1961
Hooker Chemical Corp				Due on stream 2nd quarter 1961. Plant on stream.
Hooker Chemical Corp				Plant planned.
Hooker Chemical Corp	Tacoma, Wash	Perchlorethylene		Due on stream Sept. 1960.
Houston Chemical Corp	Beaumont, Tex			
Houston Chemical Corp	Beaumont, Tex			Plant planned \$10-million plant due to start produc-
Humble Oil & Refining Co		lead		tion 1961; capacity unconfirmed. Estimate of expanded capacity, under
Humble Oil & Refining Co	Baton Rouge, La			construction. Planned expanded canacity.
Humble Oil & Refining Co	Baytown, Tex	Ortho-Xylene		Expanded capacity due end of 1960.
Humble Oil & Refining Co	Baytown, Tex			Expanded capacity due 1st half 1962.
Humble Oil & Refining Co	Baytown, Tex	Benzene		Expanded capacity from current levels of 30 MM gal./yr. benzene, 32 MM
		Toluene	35 MM gai./yr.	gal./yr. toluene; under construction.
Humble Oil & Refining Co			110 MM lb./yr.	Plant on stream.
Intermediates, Inc	Joliet, Ill			\$350,000 plant on stream.
Jefferson Chemical Co	Conroe, Tex:	chemicals Polypropylene glycol, pro-		First-phase modifications completed on
Consider Comment Comment	Confee, Text	pylene oxide triols, morpho-		plant purchased in 1959.
		line, surfactants		pant parameter in the
Lithium Corp. of America				Expanded capacity due Jan. 1961.
Merck & Co	Danville, Va	Monosodium glutamate	***************	Planned \$2-million project doubles plant
Minnesota Mining & Mfg. Co	Decatur, Ala	Fluorochemicals		capacity. Due on stream mid-1961. Due on stream early 1961; will use
Miniceota Mining & Mig. Co	Decatur, Ala	r idoroenemicais		electrochemical techniques.
Mobay Chemical Co	New Martinsville, W. Va	Toluene diisocyanate	40 MM lb./yr.	Expanded capacity due completed June 1961.
Mobil Chemical Co	Beaumont, Tex	Benzene		Multimillion-dollar plant due on stream around end of 1961.
Mobil Oil Co	Beaumont, Tex	Toluene	yr. 380 MM lb./yr.	Plant under construction.
Monochem		Acetylene	80 MM lb./yr.	\$50-million contract awarded; due on
Monsanto Chemical Co	A C-116	Vinyl chloride monomer		stream in 1962; natural gas feed.
Monmanto Chemical Co	Avon, Calif	Phenolsulfonic acid		Due on stream March 1961. Will boost Monsanto capacity by 50%.
Monsanto Chemical Co	Chocolate Bayou, Tex	Benzene, naphthalene, ethy-	7-10 MM bbl./yr.	Estimated \$100-million plant due on
		lene and others	feed	stream in 1962 using petroleum and
				natural gas liquids feed; Monsanto calls it move toward self-sufficiency
				in hydrocarbon raw materials.
Monsanto Chemical Co Monsanto Chemical Co		Plasticizers for vinyl resins	100 3535 11 /	On stream.
Monsanto Chemical Co	Kearny, N. J.	Styrene	100 MM lb./yr.	Seeking site. Due on stream 1961.
Monsanto Chemical Co	Logan Township, N. J	Phthalic anhydride and	*************	Under construction. Due on stream
		phthalate ester plasticizers		1962. New facilities to boost Mon-
				santo's total capacities 30% (anhy- dride) and 50% (ester).
Monsanto Chemical Co	Monsanto, Ill	Dihydroxydiphenyl sulfone		Plant on stream.
Monsanto Chemical Co	St. Louis, Mo	Acetylsalicylic acid		Expansion due completed Oct. 1960.
Monanto Chemical Co		Maleic anhydride	20 MM lb./yr.	Expanded plant on stream.
Moneanto Chemical Co	Texas City, Tex	Phenol	50-75 MM lb./yr.	\$6-8-million plant due completed mid- '62; will use cumene feedstock.
Monsanto Chemical Co	Texas City, Tex	Styrene	560 MM lb./yr.	Estimate of expanded capacity under
				construction.
Monanto Chemical Co	Texas City, Tex	Vinyl chloride monomer	150 MM lb./yr.	Expanded capacity completed by July.
MSA Research Corp	Callery, Pa	Potassium-t-butyl alcoholate powder	************	Construction completed.
The Nease Chemical Co., Inc	Salem, Ohio	Organic chemicals for	************	Plant opening planned.
Newport Industries Co	Oakdale, La	pharmaceuticals. Tall oil	24,000 tons/yr.	Due on stream Jan. 1961; crude capacity.
Olin-Mathieson Chemical Corp	Doe Run, Ky	Glycerin	30-35 MM lb./yr.	Ground breaking Dec. 1960; on stream
One-Machieson Chemical Corp	Doe Run, Ry	Giyeerii	50-55 MM 10./yr.	early 1962; capacity unconfirmed.
Pacific Carbide & Alloys Co	Portland, Ore		5 MM lb./yr.	\$500,000 plant on stream.
S. B. Penick & Co	Newark, N. J	Antibiotics		\$1.3-r illion expansion completed.
Pennsalt Chemicals Corp Pennsalt Chemicals Corp	Houston, Tex	Alkyl mercaptans	***********	Project over \$750,000, due early 1961 \$1,5-million plant due late 1960.
Petroleum Chemicals, Inc	Lake Charles, La	Ethylene	300 MM lb./yr.	Planned expanded capacity.
Petroleum Chemicals, Inc	Lake Charles, La	Propylene, 99% pure	120 MM lb./yr.	Capacity increase on stream.
Petro-Tex Chemical Corp	Houston, Tex	Maleic anhydride	30 MM lb./yr.	Due on stream mid-1961; plant will use
Petro-Tex Chemical Corp	Houston, Tex	Tetrahydrophthalic	"Multimillion	cheaper C4 feed instead of benzene. Planned facility due on stream Oct.
a one a calculated corps	arouston, acarres and acarres	anhydride	lb./yr."	1961; will be second in U. S.
Phillips Chemical Co	Sweeny, Tex	Ethylene	290 MM lb./yr.	Estimate of expansion under construc-
Phillips Petroleum Co	Houston, Tex	Benzene	99 MM e-1 /	tion. Due on stream by mid-1961.
Pitteburgh Chemical Co	Neville Island, Pa	Maleic anhydride	22 MM gal./yr. 20 MM lb./yr.	Due completed 1st quarter, 1960.
Plymouth Oil Co	Texas City, Tex	Benzene	15 MM gal./yr.	\$2-million Hydeal unit; due 1961.
Reichhold Chemicals, Inc		Vinyl monomer	50 MM lb./yr.	Planned site not yet disclosed.
Reichhold Chemicals, Inc	Carteret, N. J	Melamine crystal	Initially5MMlb./	Due on stream (at 5 MM lb./yr.) before
			yr.; ultimately	middle of 1961.
Reichhold Chemicals, Inc	Elizabeth, N. J.	Maleic anhydride	60-100 MM lb. 20 MM lb./yr.	\$4-million plant on stream soon; will be
				second unit at Elizabeth.
Reichhold Chemicals, Inc	Houston, Tex		50 MM lb./yr.	Due to start construction soon.
Reichhold Chemicals, Inc	Newark, Ohio	Phthalic anhydride	60 MM lb./yr.	Due on stream late 1961.

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Organics — Continues				
Company	Location	Products	Capacity	Status and Remarks
Reichhold Chemicals, Inc	Tuscaloosa, Ala	Phenol	90 MM lb./yr.	Expanded capacity due soon; will increase output by 30 MM lb./yr.
William H. Rover, Inc		Pharmaceuticals		\$2-million expansion program planned.
Shell Chemical Co	Norco, La	Acrolein		Due on stream late 1960.
Shell Chemical Co	Norco, La	Glycerin	35 MM lb./yr.	Near completion.
Shell Chemical Co		Styrene		Expanded capacity due early 1961.
Shell Chemical Co	Wilmington, Calif.; Houston, Tex.; Wood River, Ill.	Benzene	60 MM gal./yr.	Expanded capacity on stream, triples output.
Signal Oil & Gas Co	Houston, Tex	Benzene	17 MM gal./yr.	Hydeal unit, went on stream early 1961.
Sinclair Oil Co	Houston, Tex	Ortho-Xylene		Due on stream 1961.
Sinclair-Koppers Chemical Co		Styrene	70 MM lb./yr.	\$12-million plant due summer 1961.
Socony Mobil Oil Co		Butadiene	15,000 tons/yr.	Under construction, due on stream 1961.
South Hampton Co	Silabee, Tex	Bensene	6 MM gal./yr.	Hydeal unit, started up fall 1960 but not yet at full production.
Standard Oil Co. of Calif	Richmond, Calif	Para-XyleneOrtho-Xylene	41 MM lb./yr. 100 MM lb./yr.	Under construction, part of \$17-million complex.
Sun Oil Co	Marcus Hook, Pa	Benzene	12 MM gal./yr.	Planned capacity increase.
Sun Oil Co	Toledo, Ohio	Naphthalene	100 MM lb./yr.	\$8-million project due end of 1961.
SunOlin Chemical Co	Marcus Hook, Pa	Ethylene	225 MM lb./yr.	Planned \$20-million plant due on stream
Building Chemical Co	Indicos Moon, Marris	Ethylene oxide	55 MM lb./yr.	late 1961.
Suntide Refining Co	Corpus Christi, Tex	Benzene	6 MM gal./yr.	Hydeal unit, due completed early 1961.
Suntide Refining Co	Corpus Christi, Tex	Ethylbenzene	30 MM lb./yr.	Construction planned for spring and summer 1961.
Suntide Refining Co	Corpus Christi, Tex	Styrene	60 MM lb./yr.	To be completed early 1962.
Swift & Co	Hammond, Ind	Epoxidized oils and fatty		Capacity increase due on stream early this year.
Tennessee Eastman Corp	Kingsport, Tenn	Dimethyl terephthalate, terephthalic acid	************	Plant due completed late 1961.
Tennessee Gas Transmission Co.	Houston, Tex		150 MM lb./yr.	Multimillion-dollar project starts this
and Cary Chemicals, Inc		Vinyl chloride		year, due completed in 1962.
Tennessee Oil Refining Co		Aromatica		Construction contract awarded. Facilities include: 6,000-bbl./day extalytic reformer; 2,000-bbl./day extraction unit for benzene, toluene, xylenes; 22-MM-lb./yr eylene fractionation unit; 20-MM-lb./yr. ethylbenzene fractionator. Project due completed by mid-1961.
Texaco, Inc	Port Arthur, Tex	Bensene	30 MM gal./yr.	Due on stream 2nd quarter 1962.
Texaco, Inc	Westville, N. J	Cumene	70 MM lb./yr.	Plant on stream. Raw materials are benzene and propylene.
Thompson Chemical Co	Pawtucket, R. I	Lauroyl peroxide		Plant on stream.
Tidewater Oil Co. and Collier Carbon & Chemical Co.	Delaware City, Del.	Naphthalene	100 MM lb./yr.	Contract let for hydrodealkylation unit.
Tidewater Oil Co. and Collier Carbon & Chemical Co.	Los Angeles, Calif	Naphthalene	100 MM lb./yr.	Plant planned.
Union Carbide Chemicals Co	Brownsville, Tex	Acetic acid, anhydride, MEK		Due on stream early 1961.
Union Carbide Chemicals Co	Texas City, Tex	Oxo alcohols	120 MM lb./yr.	Estimated expansion under construction.
Universal Oil Products Co	Shreveport, La	Alkyl-substituted phenols		Under construction, due early 1961.
Witco Chemical Co	Chicago, Ill	Phthalic anhydride		Plant on stream.
Wyeth Laboratories	Philadelphia, Pa	Pharmaceuticals	************	\$8-million project due Feb. 1961.

Company	Location	Products	Capacity	Status and Remarks
American Oil Co	Texas City, Tex	Petroleum products	***************************************	Expansion program under way, includes new crude unit (150,000 bbl./day), catalytic cracking unit (47,600 bbl./ day), and alkylation unit (14,600 bbl./day).
Ashland Oil & Refining Co	Catlettsburg, Ky	Gas oil	75,000 bbl./day	Vacuum still due spring 1961.
CATCGroup			175 MM cf./day	\$1-3-million plant completed.
Champlin Oil & Refining Co	Enid, Okla	Petroleum coke	4,000 bbl./day crude oil input	\$1.5-million contract awarded to convert existing thermal cat crackers into a delayed coker.
Chemoil Corp	Between New Orleans and Baton Rouge, La.	Petrochemicals	************	Construction schedule not yet announced for \$60-million plant.
Collier Carbon & Chemical Corp	Contra Costa County, Calif	Calcined petroleum coke		Construction completed.
Continental Oil Co	Electra, Tex	Natural gasoline	*************	Plant completed.
Continental Oil Co	Jal, N. M	Natural gasoline	5 MM cf./day feed	Plant completed.
Continental Oil Co	Pecos, Tex	Natural gasoline	**************	Expansion completed.
Continental Oil Co	Ponca City, Okla	Greases		\$380,000 modernization and expansion completed.
D X Sunray Oil Co	Tulsa, Okla	Petroleum waxes	100 MM lb./yr.	\$7-million solvent dewaxing plant on stream.
D X Sunray Oil Co	Tulsa, Okla	Refinery intermediates	85,000 bbl./day	Crude distillation unit planned.
Florida Hydrocarbons Co	Brooker, Fla	Natural gas liquids		\$7-million plant planned; requires approval from Fed. Power Commission for increase in parent firm's gas supply. (Parent firm: Houston Corp.)
Frontier Refining Co	Salt Lake City, Utah	Refinery products	7.500 bbl./day	Planned expanded capacity.
Humble Oil & Refining Co	King Ranch, Tex	Natural gas products	800 MM cf./day gas, 28,000 bbl./ day natural gas liquids feed	\$68-million project includes pipeline to Houston; now on stream.
Husky Hi-Power, Inc	Cody, Wyo	Refinery products	9,000 bbl./day	Planned expanded capacity includes new cracking and alkylation units.

Petroleum and Natural Gas Products—Continued_____

Company	Location	Products	Capacity	Status and Remarks
Kerr-McGee Oil Industries, Inc	Pinta Field, Ariz	Helium	2.5 MM cf./day	\$2-million plant due on stream before Sept. 1961.
La Gloria Oil & Gas Co	New Rayne Field, Tex	LPG	15,000 bbl./day	\$3.9-million plant on stream.
Monarch Oil Corp	Signal Hill, Calif	Petroleum products Petroleum products	5,000 bbl./day	Modernization of 5,000 bbl./day refinery. Expansion program; due completed 1961, consists of installing Unifing unit.
N G L Corp Northern Gas Products Co	Orange, Tex Bushton, Kan	Natural gas products Propane, butane, isobutane, ethane, natural gasoline	20,000 bbl./day 900 MM cf./day total feed	Plant planned. \$10-million extraction and storage fa- cilities inside salt cavern.
Odessa Natural Gasoline Co. and Warren Petroleum Corp.	Midland Co., Texas	Natural gasoline	20 MM cf./day feed	Plant construction started August 1963.
The Ohio Oil Co	Scipio, Mich	Natural gasoline	19.2 MM cf./day feed	Expanded capacity completed.
Phillips Petroleum Co	Abbeville, La	Natural gas products	45 MM cf./day	Due on stream Dec. 1960; constructed and operated by Phillips under joint venture pact.
Phillips Petroleum Co	Stephenville, Tex	LPG, natural gasoline	50,000 gal./day	Due completed March 1, 1961.
Shell Oil Co	Houston, Tex	Distillate fuels	30,000 bbl./day 6,500 bbl./day	Hydrotreater, on stream. Hydrotreating unit, on stream.
Shell Oil Co	Martinez, Calif	Lube oil stocks	5,000 bbl./day	Hydrotreater planned for mid-1961.
Shell Oil Co	North Rincon Field, Tex	Natural gas products	35MMcf./day feed	Plant planned.
Shell Oil Co	Provident City, Tex	Propane	12,000 gal./day	Capacity increases due completed early
		Natural gasoline	5.000 gal./day	1961.
Shell Oil Co	Sealy Field, Tex	Natural gas products	16 MM cf./day feed	Plant planned.
Signal Oil Co	Houston, Tex	Refinery intermediates	15,000 bbl./day feed	New cat cracker planned.
Sinclair Oil Co	Silabee, Tex	Natural gas products	50 MM ef./day feed	Expansion from 35 MM cf./day now on stream.
Skelly Oil Co Standard Oil Co. of California	Minneola, Kan Barber's Point, Hawaii	Natural gasoline Petroleum products	15,000 gal./day 32,000 bbl./day	Plant planned. \$65-million plant partially on stream;
Standard 00 Cr (I-1)	0 W			full completion 1962.
Standard Oil Co. (Ind.) Standard Oil Co. (Ind.)	Casper, Wyo	Refinery intermediates	37,000 bbl./day	Crude plant under construction.
The Standard Oil Co. (Ohio)	Whiting, Ind Cleveland, Ohio	Alkylate Light catalytic gasoline	12,000 bbl./day 1,000 bbl./day	Alkylation unit, due early 1961. Merox sweetening unit on stream; con-
The Standard Oil Co. (Ohio)	Cleveland, Ohio	Mixed butanes	7,100 bbl./day	version of existing equipment. Merox unit for mercaptan removal; on
The Standard Oil Co. (Ohio)	Toledo, Ohio	Light catalytic gasoline	12,000 bbl./day	stream. Merox sweetening unit on stream; con-
The Standard Oil Co. (Ohio)	Toledo, Ohio	High-octane gasoline stocks.	7,500 bbl./day	version of existing equipment. Due in full commercial production early
Sun Oil Co	Marcus Hook, Pa	Refinery intermediates		1962; Isocracking process. \$9.3-million separation plant due on stream Nov. 1961.
Sun Oil Co	McComb, Miss	Natural gasoline, butane and		Plant on stream.
Texaco, Inc	Casper, Wyo	Petroleum products		Hydrotreater on stream.
Texas Gas Exploration Corp. and Runnels Gas Products Corp.	Eunice, La	Natural gas products	800 MM cf./day feed	Expanded capacity being built.
Texas Gulf Producing Co	Ector County, Tex	Natural gas liquids	40 MM cf./day feed	Due on stream Jan. 1961; condensate fractionation unit.
Tidewater Oil Co	Avon, Calif	High-octane gasoline stocks	20,000 bbl./day	\$20-million plant due on stream late 1962: Isocracking process.
Union Oil Co	Los Angeles, Calif	Petroleum products		Refinery under construction.
Union Oil Co. of California and Goliad Corp.		Natural gas products	450-500 MM cf./ day	Liquid extracted by \$13-million plant, now on stream, is fractionated into ethane, propane, butane and natural gasoline near Baton Rouge.
Western Petrochemical Corp	Chanute, Kan,	Petroleum products	*******************************	\$1.3-million expansion and moderniza- tion program completed, has doubled output.

Plastics, Resins and Synthetic Fibers.

Company	Location	Products	Capacity	Status and Remarks
Air Reduction Co	Calvert City, Ky	Polyvinyl alcohol resin	20 MM lb./yr.	Plant completed.
Allied Chemical Corp	Baton Rouge, La Chesterfield, Va	Polyethers	20 MM lb./yr.	Plant due to be completed June 1961. Expansion, due completed mid-1961.
Allied Chemical Corp	Hopewell, Va	Nylon-6 tire cord		\$2-million expansion will triple produc- tion; completion by mid-1961.
Allied Chemical Corp	Irmo, S. C	Nylon yarn	*************	Plant due completed late 1961.
Allied Chemical Corp	Orange, Tex	Polyethylene	10-15 MM lb./yr.	Capacity expansion, due on stream 1961.
American Alkyd Industries	Carpentersville, Ill	Polyester and other resins		\$500,000 plant due on stream late 1960.
American Alkyd Industries	Richmond, Calif	Synthetic resins	500,000 lb./wk.	Plant on stream.
American Cyanamid Co	Fortier, La	Methyl methacrylates	30 MM lb./yr.	New plant due on stream in 2 years; capacity unconfirmed.
American Cyanamid Co	Vancouver, Wash	Paper resins		Due completed early 1961; cost less than \$1 million.
American Enka Co	Enka, N. C.	Nylon-6 heavy-denier yarns.	35 MM lb./yr.	Two expansions: from 17 to 20 MM lb./ yr. due completed early 1961; from 20 to 35 MM lb./yr. due completed by mid-1962.
Amoco Chemical Corp. and Standard Oil Co. of Indiana	Texas City, Tex	Hydrocarbon resins	***************************************	Due on stream 1961. Will double com- pany's total resin capacity.
AviSun Corp	New Castle, Del	Polypropylene	120 MM lb./yr.	Under construction; capacity uncon- firmed.
AviSun Corp	New Castle, Del	Polypropylene fibers	10 MM lb./yr.	On stream around Sept. 1961.

Plastics, I	Resins	and	Synthetic	Fibers -Continued	
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Company	Location	Products	Capacity	Status and Remarks
Celanese Corp. of America Celanese Corp. of America Cosden Petroleum Corp	Pampa, Tex	Acrylates	10 MM lb./yr. 40 MM lb./yr.	Construction will double capacity. Capacity increase on stream. Expanded capacity planned from 20
Courtaulds, Ltd	Mobile, Ala	Cellulosic fibers		MM lb./yr. Going on stream, makes high modulus fiber.
Dow Chemical Co	Ironton, Ohio	Polyethylene foam		Due on stream June 1961.
Dow Chemical Co	Bay City, Mich	Polypropylene	10 MM lb./yr. 40 MM lb./yr.	Now building; capacity unconfirmed. Plant on stream.
Dow Chemical Co	Plaquemine, La	Polypropylene	30 MM lb./yr.	Now building; capacity unconfirmed.
E. I. duPont de Nemours & Co	Florence, S. C	Polyester film		Construction due completed spring 1961.
E. I. duPont de Nemours & Co E. I. duPont de Nemours & Co	Orange, Tex	Polyethylene, high-density Nylon tire cord		On stream. Multimillion-dollar expansion from 40 MM lb./yr., now on stream.
E. I. duPont de Nemours & Co	Seaford, Del	Carpet nylon		\$9-million expansion under way.
E. I. duPont de Nemours & Co Escambia Chemical Corp	Tonawanda, N. Y	Polyvinyl-fluoride film Methacrylates		Multimillion-dollar; on stream mid-1962. Seeking plant site; hopes to be on stream
				in 12-18 mos. Capacity unconfirmed.
Firestone Tire & Rubber Co		Polypropylene	10 MM lb./yr.	On stream by 1962; capacity unconfirmed.
Firestone Plastics Co	Pottstown, Pa	Polyvinyl chloride resins Nylon filament	10 MM lb./yr.	Expansion, due completed early 1961. On stream; making tire cord.
Food Machinery & Chemical Corp.	Baltimore, Md	Epoxy resins		Expansion program completed.
Foster-Grant Co., Inc		Polystyrene	25 MM lb./yr.	Capacity increase due completed 1961.
Foster-Grant Co., Inc	Baton Rouge, La	Polyethylene Nylon	20 MM lb./yr.	Plant planned; capacity unconfirmed. Proposed project, est. over \$5 million.
Foster-Grant Polyolefins Co	Beaumont, Tex	Polyethylene	12 MM lb./yr.	Multimillion-dollar plant, mid-1961.
General Chemical Co. (Allied)	Baton Rouge, La	Fluorohalocarbon resins		Due on stream early 1961.
General Flectric Co	Mt. Vernon, Ind	Polycarbonate resins	5 MM lb./yr.	\$5-million facility on stream. Plant on stream.
B. F. Goodrich Chemical Co B. F. Goodrich Chemical Co	Akron, Ohio Long Beach, Calif	ABS resins	20 MM lb./yr.	Plant on stream. Plant on stream; capacity unconfirmed.
Goodrich-Gulf Chemical Co., Inc.	Port Neches, Tex	Polyethylene, high-density	13 MM lb./yr.	Plant under construction, due April 1961.
Goodyear Tire & Rubber Co	Niagara Falls, N. Y	Vinyl resine	20 MM lb./yr.	Capacity increase includes provision for specialty dispersion reains; due fall 1960; cost over \$1 million.
W. R. Grace & Co	Baton Rouge, La	Polyethylene, high-density	75 MM lb./yr.	Construction for expanded capacity due to start early 1961, for early 1962 completion. Expansion will increase capacity by 50%.
Hartford Fibers Co	Rocky Hill, Conn	Cellulosic fibers	15 MM lb./yr. 10 MM lb./yr.	On stream, makes high-modulus fibers. Plant bought from Industrial Rayon
Hercules Powder Co	Lake Charles, La	Polypropylene and linear polyethylene	120 MM lb./yr.	will be converted from nylon. Due on stream early 1961; new 60 MM lb./yr. plant will bring Hercules total capacity to 200 MM lb./yr., including
Hercules Powder Co	Parlin, N. J	Polyethylene, high-density Styrene-butadiene copolymer	60 MM lb./yr.	60 MM lb./yr. already being made at Lake Charles and 80 MM lb./yr. at Parlin, N. J. Planned expansion will double output. Plant completed.
	Addyston, Ohio	resins Styrene, acrylonitrile, buta- diene monomers, styrene-	50 MM lb./yr.	Due on stream late 1961.
		acrylonitrile copolymers		
Monanto Chemical Co	Texas City, Tex	Polyethylene	100 MM lb./yr.	Estimated expansion being built.
National Starch & Chemical Corp. Nopco Chemical Co	Chattanooga, Tenn	Polyvinylidene chloride resins Urethane foams	14 MM lb./yr. 4 MM lb./yr.	Plant on stream. Plant due completed Mar. 1961; cost is over \$1 million.
Novamont Corp Owens-Corning Fiberglas Corp		Polypropylene resin	25 MM lb./yr. 70 MM lb./yr.	Due on stream Mar. 1961. Initial operation started.
Phillips Chemical Co		Polyethylene		Planned \$2-3-million expanded capacity
	a democrati, a construction of the	100000000000000000000000000000000000000	200 0202 200, 300	due on stream 1961.
Plastic Materials & Polymers, Inc. Polymer Industries, Inc	Hicksville, L. I., N. Y Springdale, Conn	Polystyrene	6 MM lb./yr.	Due on stream Jan. 1961. Expansion completed.
Reichhold Chemicals, Inc	Carteret, N. J	specialty polymers Phenolic molding compounds	25 MM lb./yr.	Under construction; due spring 1961.
Reichhold Chemicals, Inc	Jacksonville, Fla	Polyester and alkyd resins	10 MM lb./yr.	Planned \$500,000 expanded capacity.
Rexall Drug & Chemical Co	Santa Ana, Calif	Polystyrene	12 MM lb./yr.	Construction under way on expansion. Polyethylene unit due late 1961.
Rexall Drug & Chemical and El Paso Natural Gas Co.	Odessa, Tex	Polyethylene, polypropylene.	yr.	
		Polyvinyl chloride film		gram nearly completed.
Rohm & Haas Co	Louisville, Ky	Methyl methacrylate mono- mers, acrylic molding powder		\$12-million unit due on stream mid- 1961, after renovation of former buta- diene plant.
Shell Chemical Co	Woodbury, N. J		80 MM lb./yr.	Plant construction starting mid-1961, on stream in 1962.
Solar Corp	Leominster, Mass	Virgin crystal and high- impact polystyrene		\$2-million construction started; more than double present capacity.
Spencer Chemical Co	Orange, Tex	Polyethylene	135 MM lb./yr.	Construction under way on expanded
Tennessee Eastman Chemical Co	Kingsport, Tenn	Polyester fiber	20 MM lb./yr.	capacity. Capacity unconfirmed. Final construction due completed last half 1961. First units, however, were
Texas Eastman Chemical Co	Longview, Tex	Polypropylene	20 MM lb./yr.	due on stream late 1960. On stream by 1962.
Union Carbide Caribe	Ponce, Puerto Rico	Polyethylene	110 MM lb./yr.	High-pressure plant; building.
Union Carbide Chemicals Co	Texas	Polyethylene	170 MM lb./yr.	Plans announced to expand two separate
U. S. Industrial Chemicals Co	Houston, Tex	Polyethylene	100 MM lb./yr.	units by indicated total capacity. Now on stream; company's second poly- ethylene unit at site.
	Langley & C	Unsaturated polyester resins.	3 MM lb./vr.	Due on stream by late spring 1961.
Valehem	Light gaby, G. Co			

Puln	and	Paper
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Company	Location	Products	Capacity	Status and Remarks
Boise Cascade Corp	Wallula, Wash	Kraft paper	375 tons/day	Expanded capacity due completed 1961, cost over \$5 million.
Bowaters Carolina Corp	Catawba, S. C	Printing papers		Expansion planned.
Bowaters Southern Paper Corp	Catawba, S. C	Printing paper	75,000 tons/yr.	Plant due on stream by 1962.
Brunswick Pulp & Paper Co	Brunswick, Ga	Bleached sulfate pulp	1,000 tons/day	Expanded capacity, to cost \$35 million.
Buckeye Cellulose Corp	Foley, Fla	Cellulose	33,000 tons/yr.	Planned capacity increase.
Consolidated Water Power & Paper Co.	-	Enamel paper		Planned expanded capacity.
Continental Can Co	Augusta, Ga	Bleached board		Plant on stream.
Crown Zellerbach Corp	Kremmling, Colo	Newsprint		Multimillion-dollar project planned.
Crown Zellerbach Corp	Port Angeles, Wash	Newsprint, telephone- directory paper		\$700,000 modernization planned.
Crown Zellerbach Corp	Port Townsend, Wash	Pulp		
Crown Zellerbach Corp	West Linn, Ore	Paper products		
Deerfield Glassine Co	Augusta, Ga	Glassine		Plant due on stream spring 1961.
Dixie Land & Timber Co	Phenix City, Ala	Kraft and liner board		\$30-million mill due early 1962.
Fibreboard Paper Products Corp	Antioch, Calif	Kraft linerboard		New board machine has been installed to expand capacity.
Finch, Pruyn & Co., Inc	Glens Falls, N. Y			equipment installed.
Fraser Paper Ltd	Madawaska, Me			stalled.
Georgia-Pacific Corp	Olympia, Wash			\$1.5-million project due Mar. 1961.
Georgia-Pacifie Corp	Toledo, Ore		650 tons/day	Expanded capacity completed, including new 175-in. paper machine.
Gilman Paper Co	Gilman, Vt	Paper		New stock-preparation equipment will be installed; 174-in, paper machine will be rebuilt.
Green Bay Pulp & Paper Co	Crockett, Tex	Linerboard		Plant planned.
Halifax Paper Co	Roanoke Rapids, N. C	Pulp	800 tons/day	Est. \$1.75-million expansion planned.
International Paper Co	Pine Bluff, Ark	Newsprint, telephone- directory paper.		Third paper machine now on line.
Keyes Fibre Co	Sacramento, Calif	Molded pulp products		Plant planned.
Kimberly-Clark Corp	Anderson, Calif	Pulp and paper		Plant planned.
Lignin Products Co	Johnsonburg, Pa	Pulping waste byproducts		Plant on stream.
Longview Fibre Co	Longview, Wash	Lightweight paper	*************	
Marathon Southern Corp	Naheola, Ala	Board		
Menasha Wooden Ware Corp	North Bend, Ore	Pulp and paper		1961.
Nekoosa Edwards Paper Co	Nekoosa, Wis	Paper		
Nicolet Paper Corp	West DePere, Wis	Paper		New 160-in, paper machine operating.
Olin-Mathieson Chemical Corp	West Monroe, La	Pulpwood chips		Plant due completed 1961.
Puget Sound Pulp & Timber Co	Bellingham, Wash	Pulping waste byproducts	************	One expansion completed; another planned.
Rayonier, Inc	Hoquiam, Wash	Recovered pulping chemicals.	*************	\$1-million recovery system, due early 1961, is part of \$7.5-million program for conversion to sodium-base sulfite.
Rayonier, Inc	Hoquiam, Wash	Bleached pulp	200 tons/day	\$2.4-million project due to start con- struction Mar. 1961.
St. Croix Paper Co	Woodland, Me	Newsprint		Capacity of newsprint machine increased.
St. Marys Kraft Corp	St. Marys, Ga	Kraft		New 236-in. paper machine planned.
St. Regis Paper Co	Bucksport, Me	Coated printing paper		Est. \$8.5-million expansion planned.
St. Regis Paper Co	Tacoma, Wash	Kraft		\$30-million expansion under way.
Southern Land, Timber & Pulp Co.	Cedar Springs, Ga	Pulp and paper	750 tons/day	\$42-million mill planned.
Southwest Forest Industries, Inc.	Snowflake, Ariz	Pulp and paper	140,000 tons/yr.	\$32-million mill completion late 1961.
Tennessee River Pulp & Paper Co.	Counce, Tenn	Pulp and paper		\$30-million mill under construction.
West Virginia Pulp & Paper Co	Wellsburg, W. Va	Multiwall products		\$700,000 modernization planned.
Weyerhaeuser Co	Cloquet, Minn	Shipping-container sheet		Mill under construction.
Weyerhaeuser Co	Lynchburg, Va	Shipping-container sheet Shipping-container sheet		Mill on stream. Mill under construction.

Rubber

Company	Location	Products	Capacity	Status and Remarks
American Rubber & Chemical Co. American Rubber & Chemical Co.	Louisville, Ky	Natural synthetic rubber Synthetic rubber and elastomers	30,000 tons/yr.	Plant on stream late 1961 or early 1962. Planned semiworks unit; will use Crawford & Russell's stereospecific rubber process. Due on stream early 1961.
Burkart-Schier Chemical Co Firestone Tire & Rubber Co Firestone Tire & Rubber Co	Chattanooga, Tenn Lake Charles, La Orange, Tex	Compounded latex	30,000 tons/yr.	Plant planned. Due on stream early 1961. Due on stream early 1961.
Goodrich-Gulf Chemicals, Inc	Institute, W. Va	Polybutadiene	20 MM lb./yr.	Due on stream late 1961. Replaces earlier plans for 25,000-ton/yr. poly- isopreme plant at Orange, Tex., or Institute. W. Va.
Goodyear Tire & Rubber Co	Akron, Ohio	Nitrile rubber, synthetic latexes		\$1.25-million expansion, due completed June 1961, increases capacity 15%.
Goodyear Tire & Rubber Co Phillips Chemical Co	Beaumont, Tex	Natural synthetic rubber Natural synthetic rubber	40,000 tons/yr. 25,000 long tons/	Due mid-1961; capacity unconfirmed. Due to start shipments Jan. 1961.
Shell Chemical Co	Marietta, Ohio	Monomer and natural syn- thetic rubber	80 MM lb./yr.	Multimillion-dollar plant due on stream late 1961.
Shell Chemical Co	Torrance, Calif	Polybutadiene, polyisoprene,.	20,000 tons/yr.	Plant planned.
Shell Chemical Co	Torrance, Calif	Polyisoprene	40 MM lb./yr.	Plant on stream.
Shell Chemical Co	Wood River, Ill	Polyisoprene	40,000 long tons/ yr.	Plant planned.
Texas-U. S. Chemical Co	Port Neches, Tex	Synthetic rubber	156,000 long tons/ yr.	Expanded capacity due early 1961.

Rubber -Continued

Company	Location	Products	Capacity	Status and Remarks
Texas-U. S. Chemical Co	Port Neches, Tex	Polybutadiene	20,000 long tons/ yr.	Due on stream 1962. Will boost capacity polyisoprene and polybutadiene to 230,000 long tons/yr.
United Carbon Co U. S. Rubber Co	Baytown, Tex	Carbon black masterbatch Stereoregular synthetic rubbers	50 MM lb./yr.	Planned capacity increase. Planned \$2-million unit.
U. S. Rubber Reclaiming Co	Vicksburg, Miss	Reclaimed rubber	70,000 lb./day	\$1.25-million unit going on stream.

Miscellaneous.

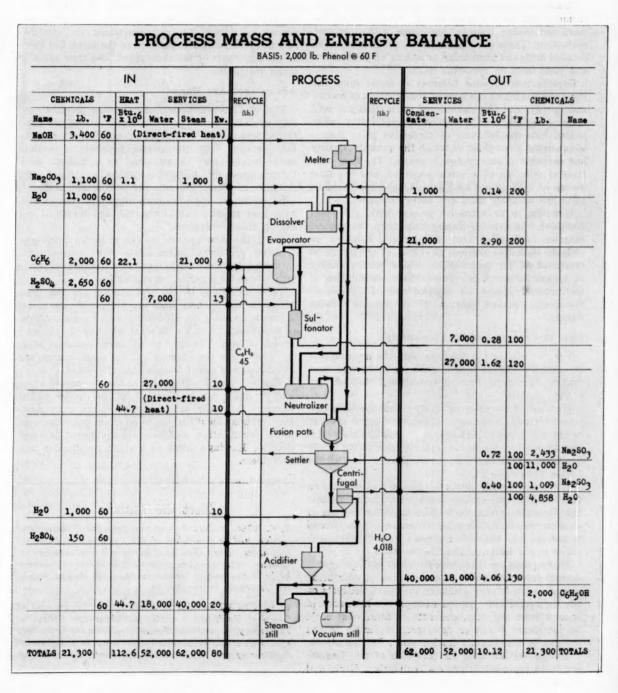
Company	Location	Products	Capacity	Status and Remarks
Adhesive Products Corp				
Archer-Daniels-Midland Co		 Nitrogen compounds, plas- ticizers, intermediates 		stream by spring 1962.
Calaveras Cement Co	Redding, Calif		************	
The Philip Carey Mfg. Co	Lockland, Ohio			Expansion, due completed early 1961.
Champion Spark Plug Co				
Columbian Carbon Co	Houston, Tex	Carbon black dispersions		\$1-million construction started.
Corning Glass Works				\$4-million project due summer 1961. Plant due on stream early 1962.
Cowles Chemical Co				Plant due on stream early 1962.
Donner-Hanna Coke Corp	Buffalo, N. Y			Expanded capacity from new 50-oven battery replacing 51 smaller ovens.
Dynacolor Corp	Rochester, N. Y	Photographic film and paper.		Expanded plant due spring 1961.
W. F. Fancourt Co	Greensboro, N. C			Plant due completed summer 1961.
Food Machinery & Chemical Corp.				Plant due completed Feb. 1961.
Food Machinery & Chemical Corp.	Baltimore, Md	Rocket fuel, miticide		\$4-million construction under way.
General Electric Co	Waterford, N. Y	Silicone chemicals		\$5-million construction under way.
Glidden Co Hanson-Van Winkle-Munning Co	Carrollton, Tex	Paints	47.000 1.6	Multimillion-dollar plant due May 1961. Expanded capacity completed.
Hercules Powder Co	Grand Rapids, Mich	Electroplating chemicals Explosives		Plant completed.
Hercules Powder Co	Salt Lake City, Utah	Solid propellants		Nearly ready for full-scale operation.
Hodag Chemical Corp	Skokie, Ill.	Emulsifiers		Plant under construction.
Hummel Chemical Co	Newark, N. J.	Hexanitroethane, hydra-	****************	On stream; products are rocket propel-
		zinium, nitroformate, and trinitromethane		lants.
Huron Portland Cement Co	Alpena, Mich	Cement		Expansion under way.
Intl. Flavors & Fragrances, Inc	Teterboro, N. J	Flavoring products		Three-year expansion program planned.
Intl. Minerals & Chemical Corp	Houston, Tex	Processed barite		\$500,000 unit due on stream Nov. 1960.
Island Creek Coal Co	Red Jacket, W. Va	Catalytic charcoal		\$600,000 unit scheduled for May 1961.
Jones & Laughlin Steel Co Kaiser Aluminum & Chemical Corp.	Pittsburgh, Pa	Coke	60,000 tons/mo	Capacity increase from new ovens. \$500,000 unit due by Jan. 1961.
Kaiser Aluminum & Chemical Corp.	Columbiana, Ohio	Special refractories	120,000 tons/yr.	\$1-million plant due fall 1960.
Jefferson Lake Sulphur Co	Copperopolis, Calif	Asbestos	2,500tons/day ore	Due completed by fall 1961.
Louisville Cement Co	Logansport, Ind	Cement		\$10-million mill due to start construc- tion early 1961.
Meer Corp	Bergen, N. J	Gums, gum products	5 MM lb./yr.	Plant on stream.
Moneanto Chemical Co	Anniston, Ala	Parathion and methyl para- thion insecticides	18 MM lb./yr.	Capacity has been increased 50%.
Monsanto Chemical Co	Monsanto, Ill	Herbicide		Construction due completed Jan. 1961.
Morningstar-Paisley, Inc	Atlanta, Ga	Liquid adhesives		Plant on stream.
Morningstar-Paisley, Inc National Sugar Refining Co	Houlton, Me	Potato starch ethers, other modified starches Refined sugar		Plant due on stream Jan. 1961. Modernization planned.
Nuodex Products Co	Reserve, La Elizabeth, N. J	Nickel catalyst		Plant due on stream Dec. 1960.
Oklahoma Cement Co	Pryor, Okla	Cement		\$8-million mill completed.
Peabody-Wright Corp	Columbia, Tenn		> 1 Mile 0011/ 3111	Project due on stream Jan. 1961.
Permanente Cement Co	Sutton, Alaska		500,000 bbl./yr.	\$5-million project planned.
Phillips Chemical Co	Orange, Tex	Carbon black	60 MM lb./yr.	Due on stream Dec. 1960.
Sid Richardson Carbon Co	Big Springs, Tex	Carbon black	50 MM lb./yr.	Oil-furnace black; due mid-1961.
Sherwin-Williams Co	Atlanta, Ga	Paint	******	Multimillion-dollar project planned.
Sun Chemical Corp	Cleveland, Indpls., St. Louis	Printing ink	000 /1	Multimillion-dollar expansions, late '62.
Susquehanna-Western, Inc Thiokol Chemical Corp	Falls City, Tex	Uranium concentrate	200 tons/day ore	\$2-million mill due about June 1961. \$30-million plant under construction;
United Carbon Co	Tremonton, Utah	Carbon black	64 MM lb./yr.	fuel for Air Force Minuteman missile. \$5-million plant planned.
	Freeport, Tex		1 MM gal./day	\$1.2-million plant, now building;
Interior	Procport, Tex	Fresh water	I Man gan/day	multiple-effect evaporation of sea water.
Office of Saline Water, Dept. of Interior			*************	\$1.6-million construction under way; flash evaporation of sea water.
Office of Saline Water, Dept. of Interior	Webster, S. D		250,000 gal./day	\$482,200 construction contract awarded; electrodialysis of brackish water.
U. S. Navy	Indian Head, Md		160,000 lb./mo.	\$3-million plant due operating soon.
Western Electric Co	Merrimack Valley, Mass	Quarts crystals	14,000 lb./yr.	\$1-million plant on stream.
The Westport Chemical Co	Longview, Wash	agents, other	************	Due on stream about Jan. 1, 1961.
Thomas L. Williams Chemical Co.	Detroit, Mich	Detergents		Modernizing plant following a fire.

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New Help in Tabulating Flowsheet Data

- Ledger form clearly shows all needed mass and energy information.
- Data become easier to understand, extract and apply.
- System's many applications reduce duplication of effort.



T. K. ROSS AND D. C. FRESHWATER

It is frequently quite difficult to show all necessary mass and energy information on a conventional flow-sheet and still preserve clarity. We feel that a "ledger" format minimizes this difficulty. The resulting improvement of presentation speeds up cross-references and eliminates confusion.

Probably the most important single activity in which chemical engineers engage is the preparation of the mass and energy balances associated with a process evaluation. These are needed for economic appraisals, detailed design of plant units, or setting up of efficiency and yield tests on operating units.

Construction of such balances is based upon the rigid application of the laws of conservation of matter and energy, and the methods of calculation are well known. The engineer is enabled, by exploratory calculations into the behavior of successive plant stages, to construct a flowsheet on which the quantity, quality and enthalpy of energy flow is shown. The final commercial selection of a process method, and the final design of the units of that process, are thus based on clear and accurate mass and energy balances.

However, in an extensive process with a complex flowsheet, the gradual development from the process diagram to detailed heat and material balances inevitably leads to some loss of clarity. The attempt to represent all the information usually results neither in a clear flowsheet nor an adequate presentation of the process. Hence, we suggest use of a "ledger" flowsheet, so-called because of its tabular column system.

How to Prepare Ledger Flowsheets

For our illustration, we have used the manufacture of synthetic phenol by the sulfonation process (see Shreve, "Chemical Process Industries," 2nd ed., pp. 878-9).

We start off by drawing up a vertical symbolic representation of the process stages, making no attempt to portray types of equipment in detail. This representation will comprise the center section of the ledger flowsheet, and is shown in our illustration between the double lines.

If we now provide space for inputs and outputs on both sides of this section, we have a blank flowsheet that should immediately be duplicated for the use of all departments. Ordinarily, no one should be allowed to prepare any alternative scheme for this purpose—either in the design office or in the plant.

We can then use this blank flowsheet to draw up any desired form of balance—inputs to the process being logged on the left-hand side of the chart, products on the right-hand side. In our example, we have entered enough flows and calculated data to form what could be considered a master flowsheet. Materials in and out can be conveniently totaled, and a balance struck.

Double vertical lines on each side of the diagram are to be regarded as process boundaries. Horizontal lines crossing these boundaries from either left or right should be considered points of entry or departure for material or energy, upon which consumption and cost data will be based. Measurement points are indicated by black dots on the boundary lines.

Some processes involve considerable amounts of internal recycle; when this is so, recycle columns may be provided just inside the process boundary lines, as in our example. Such streams, although calculated and entered on the chart, are not shown as crossing the process boundary. Their measurement and control may be required in the operation of the plant, but they do not form part of the throughput, and thus are not major cost items.

Advantages Are Many

Virtue of such a method of balancing becomes evident when one wishes to tabulate and balance any particular compound or item from a complicated flowsheet. For instance, from the master flowsheet, a cooling water balance may be extracted, or a sulfuric acid balance drawn up. A clear idea of the quantity of heat available in effluent streams can be obtained, and possible exchanges and economies suggested. Losses and byproduct streams can be charted, and means of reducing them considered.

Using the same system, we can make up flowsheets showing pressures, intermediate flow compositions, intermediate heat compositions, or any other information needed for a particular application.

Communications in the organization are improved by using this method, since the process engineer, designer or operator are all dealing with a common form of flowsheet, although a different selection of data may appear on each. The sheet should never be abbreviated. By preserving the identity of the sheet, errors are minimized and misunderstandings prevented.

Further identification between the formalized sheet and the plant can be obtained by the use of coding numbers that tally with actual plant inventory numbers. Similar identification in all other drawings used in the organization, such as spare equipment lists and detailed drawings, leads to further clarification and usefulness.

Meet the Authors

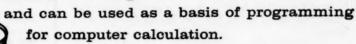
T. K. ROSS graduated in science from the University of London, and is a member of the Intitution of Chemical Engineers. After experience in the oil and chemical industries, he returned to university teaching. At present, he holds the post of Reader in Chemical Engineering at the University of Manchester.

D. C. FRESHWATER is Head of the Department of Chemical Engineering of the Loughborough College of Technology. A graduate in chemistry from the University of Birmingham, he obtained experience in the chemical engineering field before taking up university teaching.



Convenient summary form prevents the overlooking of significant items,

fits cost data into correct categories





Estimate Production Costs Quickly

JOHN W. HACKNEY, Pan-American Management, Ltd.

Manufacturing costs are raw-material costs plus costs of processing, packaging, loading and shipping the product. A typical form in which manufacturing costs can be organized and tabulated is illustrated on p. 181.

Costs are computed on an annual basis, since this is usually the clearest way to prepare and present the data, especially when seasonal variations are involved.

The costs tabulated are those incurred because of added production and investment, changes in raw materials, processing, packaging, loading or shipping. In other words, they are incremental costs. Computation by increments is usually the best and easiest way to determine the change a project will make in a company's over-all income. The objective of economic analysis is the determination of this income change and of the investment required to produce it.

Annual costs should be rounded off to the nearest \$100. Totals are rounded to not more than three significant figures.

Degree of Investigation

Considerable judgment is required in determining the extent to which individual items of manufacturing costs should be investigated. Depending on the type of operation, almost any of them may be dominant and deserve fully detailed consideration. A preliminary order-of-magnitude check will sometimes indicate which elements of cost dominate and therefore deserve complete study. There will be other cost elements that, even if drastically misjudged, will not produce sig-

nificant-figure changes in the totals. No time should be wasted on making an elaborate computation of these.

Considerable detailed computation is required for the entries on the cost form. The necessary computation sheets, with notes as to data sources, should be carefully organized and filed.

Use of Computers

The form for estimating manufacturing costs is in effect a "program" of computation. Entries on the left half of the form of such items as fuel usage and cost constitute the input data. All of the figures on the right hand side of the form, with the exception of the rate at 100% capacity, can be automatically computed. A computing program of this type will contain built-in standard factors for calculating such items as supervision, general works expense and so forth. These factors will be used unless the machine is instructed to employ special values for the project.

Initial costs of writing such a program and setting up the factors and forms to be used are substantial. Once the program is complete, however, the computer can be used to great advantage in cases where it is desirable to determine quickly and inexpensively the effect of variations in yields, investment and labor rates on manufacturing cost. Complete cost sheets are printed out in a very short space of time for each case to be studied, or the machine need report only the key

Turn page for sample estimating form



To meet your author, see Chem. Eng., April 3, 1961, p. 160.

PRODUCTION COSTS . . .

figures required to prepare graphs. Use of qualified consultants in setting up such programs can reduce their cost considerably.

For most projects, costs should be computed at 100%, 75% and 50% of added plant capacity. However, when added capacity is not large as compared with existing capacity, operating levels of 100%, 50% and 0% of added capacity should be used.

In determining total costs at various production levels, individual items fall into one of the following groups:

 Variable, where the cost per year varies directly with the production rate. This is usually the case with raw materials, fuel and containers. Cost of these items per unit of production tends to be constant, regardless of the number of units produced.

• Fixed, where the cost per year is not affected by the production rate—e.g., depreciation, taxes and insurance. General works expense is also usually assumed to be unaffected by the production rate. Cost per unit of production decreases with an increase in the units produced.

• Semivariable, where the annual cost decreases somewhat as production decreases, but not in direct proportion. For example, annual repair and maintenance costs tend to be lower at low production rates, but will be substantial even at zero production. In general, the cost per unit for semivariable items tends to increase as production goes down, but not in true inverse proportion to the production rate.

The "mix" of costs falling into these three categories determines the slope and shape of the production-return curve. It is an important project characteristic to be weighed when deciding whether or not the investment should be made.

Raw Material and Fuel Cost



The added manufacturing cost form has spaces in which are listed the raw materials and fuels required. The periodic makeup of losses of such items as catalyst and electrolytic-cell mercury is included as raw material. If the initial charges of these materials will have a long useful life (more than about one year), they are nondepreciable capital investment.

Opposite each item should be indicated the units in which the material is usually purchased, the unit cost and the usage in units of raw material or fuel per unit of production.

For raw materials and fuels not currently being purchased, approximate prices can be obtained.*

Costs of materials and fuels are entered on the cost sheet on a plant-delivered basis. Many price quotations will be fob. vendor's plant, or some other basing point, and freight to the plant must be added. Assistance in obtaining freight information can be obtained from the company's traffic department or the railroads that

Highlights in estimating an actual process

Incremental costs tabulated are those arising from added production or investment, or from changes in raw-material or manufacturing costs. Generally, costs are computed for operating levels of 100%, 75% and 50% of added capacity.

Raw materials and fuels should be listed in the units in which they are bought. Entered on "plant delivered" basis including transportation. Calculating most economical price will involve considering fob. cost plus transportation, cost of facilities and labor to receive and store, and cost of preparing material for use.

Costs are obtainable from public utilities rate sheets or from the company's standard cost data.

Man-hours are derived from a complete manning table; the rates come from local average man-hour wages. Cost generally does not change much with changes in production. The \$370,000 is capital cost, and the 5.2% a labor factor based on company experience or from the literature. Of this total repair cost, 60% is generally assigned to labor. Indirect costs are based on hourly and supervisory labor cost.

Repair supplies' cost is the remaining 40% of total repair cost (i.e., of 5.2% of \$370,000).

Operating supplies are based on a percentage of operating labor cost.

Items subject to **depreciation**, and the rate used, are based on tax laws. Depreciation is applied to direct investment plus transferred items at book value plus reserve.

Materials: Includes shipping container cost—either full cost on nonreturnable containers, or repair, cleaning, testing and depreciation on returnable containers.

^{*} From Oil, Paint, and Drug Reporter or special costs issues of Chemical and Engineering News.

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Subtotel, Labor Supplies & Miscellaneous Operating Supplies 66 of operating labor Repeir Supplies 406 of 5.26 of \$370,000 (3) Laboratory Royalties & Rentals \$1.00 /T Contingencies, 3 % of non-Fixed costs Subtotal, Supplies & Misc. xed Costs ioneral Works Expense, inc. Taxes & Ins. (4) Operaciation 8 % of \$352,000 Subtotal, Fixed Costs sading, Packing & Shipping laterials, inc. 3 % cont. \$.80 /T	,000	21,000	21,000
Operating Supplies	,400	27,400	27,400
Operating Supplies 66 of operating labor Repair Supplies 406 of 5.26 of \$370,000 (3) Leboratory	,900	164,900	\$ 164,900
Operating Supplies 6% of operating labor Repoir Supplies 40% of 5.2% of \$370,000 (3) Laboratory			
Repair Supplies 40% of 5.2% of \$370,000 (3) Laboratory	,300	6,300	6,300
Leboratory Revelties & Rentals \$1.00 /T T Contingencies, 3 % of non-Fixed costs Subtotal, Supplies & Misc. xed Costs Coneral Works Expense, inc. Taxes & Ins. (4) Depreciation 8 % of \$352,000 Subtotal, Fixed Costs seding, Pecking & Shipping Asterials, inc. 3 % cont. \$80 /T	,700	7,700	7,700
Contingencies,	-	-	-
Contingencies, 3 % of non-Fixed costs Subtotal, Supplies & Misc. xed Costs ioneral Works Expense, inc. Taxes & Ins. (4) 20epreciation 8 % of \$352,000 Subtotal, Fixed Costs seding, Pecking & Shipping laterials, inc. 3 % cont. \$.80 /T	,500	17,500	17,500
Subtotal, Supplies & Misc. xed Costs General Works Expense, inc. Taxes & Ins. Depreciation 8 % of \$352,000 Subtotal, Fixed Costs suding, Packing & Shipping Haterials, inc. 3 % cont. \$.80 /T	,400	28,400	20,700
xed Costs ioneral Works Expense, inc. Taxes & Ins. (4) Percelation 8 % of \$352,000 Subtotal, Fixed Costs seding, Pecking & Shipping laterials, inc. 3 % cont. \$.80 /T		59,900	\$ 52,200
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Subtotal, Fixed Costs	2,900	72,900	72,900
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laterials, inc. 3 % cont. \$.80 /T	,000	104,000	\$ 104,000
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		10,500	7,000
.obor 1900 nr. at φ≤.(0	,000	5,100	5,100
	,000	5,400	5,400
Subtotal, Loading, Packing & Shipping \$ 2	,000 ,100 ,400	21,000	\$ 17,500
tal Added Manufacturing Cost	,100	1,092,000	\$ 826,000
	,100 ,400 ,500	The same of the sa	J.C. L. S.
(1) 350 operating days at 50 T/D, 15 days kiln re-bricking Repair cost essentially constant for all production levels. (15 45% of \$137,500 = \$61,800, total \$72,900.	3,100 3,400 4,500 3,000		ock.
s 45% of \$137,500 = \$61,800, total \$72,900. Period by J.W.H. Dete 6/28/59 Checked by	3,100 3,400 4,500 3,000	around the clo 70,000 = \$11,10	

will be concerned (unless this is a "hush-hush" project). Perry's "Chemical Business Handbook," Section 9, is a good source of basic information on transportation costs in general.

Transferred raw materials and fuels are those obtained by transfer from another company division, which is operated as a separate entity. Transfer price is the going market price plus freight and other transportation costs from the nearest production point, whether competitive or company-owned, to the unit receiving the materials.

Prices of raw materials, whether transferred or purchased from outsiders, will vary considerably depending upon the form in which they are received Delivered prices are quite different, for example, for 50% caustic in tank cars as compared with anhydrous flake caustic in steel drums. The estimator should make sure that the most economical type has been selected.

Fuel prices vary not only with the type of fuel being purchased, but also with the number of Btu.'s per unit. Other fuel characteristics (and the corresponding prices) are dictated by the ability of the process unit to utilize them. Special heating equipment is required, for example, when the heavier types of fuel oil are burned. A separate analysis of fuel economy is sometimes required in order to select the proper type and quality of fuel.

Utilities -

The company's standard manufacturing costs can be used to price utilities provided by a "works," and for utility increments of reasonable size at other operating plants. When large increments are required, the extra utility costs are determined from rate schedules of local public utilities or from a separate new estimated manufacturing cost sheet for the utility itself.

It is especially important to analyze utility costs for large increments, since unit costs often decrease substantially as demand goes up. When projects involve small increments of utility consumption, the cost per unit can usually be assumed constant.

Labor

Operating Labor—The best means of establishing operating-labor requirements is to prepare a complete manning table showing additions or reductions made necessary by the project. This should be reviewed with personnel familiar with operating this type of unit, preferably the ones who will later run the plant. The manning table should be established for operating at 100% capacity, with notes as to reductions that can be made if the plant is consistently operated at lower rates. Round-the-clock and week-end coverage must be included when necessary. From the manning table, the annual man-hour requirements can be computed.

When the project is a novel one, some idea of labor

requirements can be obtained from publications such as T. B. Haines' "Direct Operating Labor Requirement for Chemical Processes."

Having established the number of man hours of operating labor required annually for the project, the operating labor cost is determined by multiplying man hours by the average hourly rate for the geographical area in which the new unit is to be located. Operating labor is usually a semivariable expense. In some cases, however, and especially in continuous-process plants, there can be no reduction in the operating force as production is reduced.

Repair Labor—This includes the hourly wages and average premium pay (if any) of men engaged in the maintenance and repair of the added installations. It does not include general repair supervision, depreciation on repair or service equipment, maintenance shop overhead or indirect payroll costs. These are taken care of elsewhere.

Repair labor is listed separately from repair supplies, for easier computation of indirect payroll costs. Usually, about 60% of total repair cost is labor.

Standard manufacturing cost tables for the company's existing plants are the best source of repair cost information. Very few usable data have been published. A good start in this direction has been made in two articles published in *Chemical Engineering* in 1959.* In these articles, the following formulas were developed:

Pulp and paper plants: (Source not stated)

$$M = 0.009 \, \Sigma \, (I_n \times t_n) + 149,000$$

Coke plants
(J. A. Williams, Wyandotte)

$$M = 0.004 \sum_{n=1}^{\infty} (I_n \times t_n) - 83,091$$

Cement plants (J. A. Williams, Wyandotte)

$$M = 0.011 \, \Sigma \, (I_n \times t_n) \, - \, 300,000$$

Silicone products plants: (R. Cutoff, Gen. Elect.)

$$M = 0.068 \Sigma (I_n \times t_n/L_n)$$

Electrolytic plants: (Author's notes, not included in articles)

$$M = 0.083 \, \Sigma \, (I_n \times t_n/L_n)$$

In the above formulas, M is the annual maintenance expense, I_n is the investment in a plant unit, t_n is the years that the unit has been installed and L_n is the estimated total life of the unit. Σ is the summation (between limits of 0 and n) for all of the units being maintained. For computing the average annual repair cost, t_n can be assumed at half the estimated life of the unit. It is obvious that the first three formulas are valid only for large units because of the sizable constants in them.

When a unit is operating at 75% capacity, the rule-of-thumb is that repair cost may be roughly 85% of the repair cost at full capacity. When operating at half capacity, the repair cost may be about 75 percent of the repair cost at full capacity.

<u>Supervision</u>—Additional operating and maintenance supervisors and foremen made necessary by the project are included in this category. Managers, supervisors and foremen for general plant services, such as storerooms and accounting are not included, however. They are charged to general works expense.

For quick estimates, and in the absence of other information, supervision can be assumed to average between 10 and 25% of the operating labor. Higher figures are for complex processes or a multiplicity of small units.

Supervision is considered to be a fixed expense at the level required for 100% capacity operation, except when for some special reason plans are to operate at less than capacity for a substantial length of time.

<u>Indirect Payroll Costs</u>—These include costs to the company of pensions, paid vacations, group insurance, disability pay, Social Security (company's portion), unemployment taxes, and so forth.

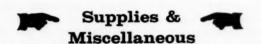
For existing plants, percentage figures are available in the company's standard cost tables. A check should be made to be sure all indirect costs of employing labor are included, but none duplicated.

In Canada for 1959, Industries Relations Counselors Service of Toronto found the following fringe cost percentages prevailed:

All manufacturing Paper																		22.	8%	
Paper																		17.	6%	
Chemicals		•							•	•		•			•		٠	23.	0%	
Chemicals Petroleum Iron and steel		•				•					•		•		•	•		24.	9%	
fron and steel												_		_			_	211.	2 1/0	

Comparisons made by the service showed no major difference of pattern between these figures and corresponding ones for the U.S.

In the absence of other information, indirect payroll costs can be estimated for new projects as being equivalent to 20% to 25% of the labor items to which they apply, that is operating labor, repair labor and supervision. Indirect payroll costs for loading, packing and shipping are handled separately.



Operating Supplies—Included here are such things as wiping cloths, lubricating oil, instrument charts, and any other items used in the normal operation of the plant, excepting those listed as raw materials or packaging materials.

Standard costs for this item should be used where available. For new plants, it may be assumed to be about 6% of the operating labor, although consideration should be given to any special process conditions

that will tend to increase this percent of labor cost.

Repair Supplies—This includes the various supplies such as emery cloth, nuts and bolts, gaskets, welding rod, oxygen, acetylene, and so forth, used in conjunction with repair work. It will usually be found that this is about two thirds of the repair labor, or 40% of total repair costs as previously discussed under "repair labor."

Laboratory and Other Service Costs—Depending on company practice and the type of project, manufacturing costs may include special service charges by other company units such as laboratories.

Laboratory costs in percent of operating labor for typical plants manufacturing the following materials:

Soda ash	 															3%
Silicates																
Chemical caustic														•		10%
Chlorine-caustic.	 				_											13%

Typical laboratory costs for the more complex processes are usually between 10% and 20% of operating labor. Other service charges will of course depend on the type and value of service rendered.

Royalties and Rentals—Royalty and other patentright payments required for the added production
should be included in this section of the manufacturing
cost tabulation if they are paid periodically or on the
basis of units of production. Under these conditions,
they are operating expense. Single-sum patent or
know-how payments, however, are usually capital investment but not subject to depreciation. In some
cases, they are amortized. The company's tax experts
should be consulted in cases of doubt as to how to
handle specific situations.

Rental payments are dependent on the value, number and type of items rented. The company's purchasing department can provide information on current rental rates for many items.

Contingencies—Since it is virtually impossible to be sure that all items have been included in the manufacturing cost, a contingency is added to the estimate. This should be small for installations like those the company currently has in operation, larger for novel processes in their initial development stages. Until further information is available, the following rates are suggested:

- Installations common to the industry, for which reliable data are available......2%

The above percentages should be applied to the subtotal of all the items of the preceding manufacturing costs. This excluded depreciation and general works expense, which already include a contingency since they are based on investment including reserve.



General Works Expense-GWE is the cost of plant overhead items such as insurance, property taxes, plant management, plant engineering, general maintenance supervision, plant technical staff, personnel services, plant protection, maintenance shops, tool rooms, storerooms, accounting, purchasing, traffic, and other related items. It also includes the depreciation, operation and maintenance costs of railroads, roads, sewers, parking lots, cafeterias and other general facilities serving the process units.

General works expense percentages are difficult to establish and compare, even between plants of the same company. Comparable results can be obtained only if accounting definitions are precise and subject to uniform interpretation. Best results are obtained by an analysis of company records, segregating the items making up general works expense into two groups, one chiefly dependent on investment, the other chiefly dependent on labor.

Some rough order-or-magnitude figures follow:

	Investment Factor	Labor Factor
Soda-ash plants	1.5%	45%
Power plants	1.8%	75%
Electrochemical plants	2.5%	45%
Cement plants	3.0%	50%
Silicate and chromium plants	4.0%	46%

As an example, take a case as follows:

1. Direct investment plus transferred facilities less forced retirements plus reserve.*.....\$1,000,000.

2. Increase in annual labor (operating, repair, supervision, loading, packing and shipping)....\$30,000.

Assuming that the project is an electrochemical plant, the general works expense would be computed as follows:

1. Investment portion, \$1,000,000 at 2.5% = \$25,000. 2. Labor portion. \$30,000 at 45% = 13,500.

3. Total general works expense In some cases, it will be necessary to make a detailed study of present general-works-expense charges prior to installation of a new unit in order to make a realistic estimate of its effect. The company's accounting department can provide assistance with such

studies. This check is especially advisable for modernizations and replacements, or when the formula indicates the general works expense will decrease.

Depreciation-Many process equipment installations can be assumed to have a depreciation rate of 8%, indicating an effective life expectancy of 12½ yr. Installation subject to rapid deterioration or obsolescence, however, should be depreciated at rates up to 20%, or possibly higher. Justification of these higher rates should be included in the appropriations request. Complete process plants, including the usual proportion of long-life improvements, such as foundations, roads, railroads, sewers, buildings, and so forth, may have a depreciation rate on the order of 63%, representing a life of 15 yr.

The depreciation rate is applied to direct investment plus transferred items at book value plus reserve; depreciation for supporting utility investment is included as a part of the utility costs.

Depletion-If applicable, depletion is one of the service costs of a project. This is an annual allowance for eventual exhaustion of some natural resources such as a salt deposit, clay pit, limestone quarry, gas well or oil well. From an income tax standpoint, the maximum depletion allowance is set by law. Currently, in the U.S. it is 271% of the annual production of material, valued at market in the first usable. salable form into which it is processed.

Amortization-Another service cost, amortization resembles depreciation and depletion. It is applicable to any intangible asset that has a limited legal life, such as a patent, license or concession. A charge is made each year against the operation so that at the expiration of the legal life of the asset, the entire cost has been written off.

Loading, Packing & Shipping

Standard manufacturing costs from other similar company operations, suitably modified to present requirements, are the best source of data for estimating this expense. Fortunately, these costs are fairly easy to measure and most companies have cost-control systems that provide actual cost information which can be used in these estimates.

Published data are available in Section 8, pp. 25-31 of Perry's "Chemical Business Handbook," and in "Chemical Engineering Cost Estimation."

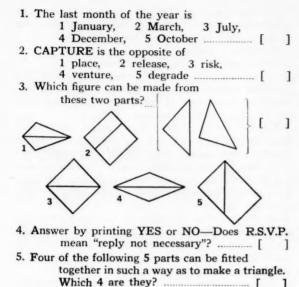
Indirect payroll costs, general works expense, supervision, and contingencies for loading, packing and shipping are handled as indicated on the form. General works expense and indirect payroll percentages are added, then multiplied successively by the supervision and contingency percentages.

Loading, packing and shipping is segregated in this way to best show the effect on costs of various forms and containers for shipment. The total of the preceding items on the sheet is bulk cost. When loading, packing and shipping costs are added, we have our "total added manufacturing cost."

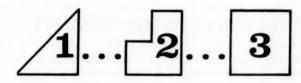
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The exact definitions of these terms will appear in an article by Mr. Hackney in a future issue of Chemical Engineering.



Testing-



Subjected to tests from cradle to grave, most engineers are finally used to them. But now testing invades a man's own home. "I prefer a job where the social dimensions are just as important as the technical dimensions." Sound like small talk from that cocktail party last weekend? It might have been, but this particular quotation appears in print, immediately followed by "A. Agree; B. Disagree."

And the *correct* answer is "B. Disagree," because the item is one of 40 in a professional inventory on human relations. Or in case you don't understand the jargon, a "personality test." The scoring weight for the correct answer to this question is as heavy as any other on the test, so there's no point worrying about what social and technical "dimensions" are—just check the answer!

Fortunately, this question doesn't appear on a test that raises or ruins your chance of employment, or determines your suitability for promotion, or singles you out as a misfit. Instead, it's part of a unique jobrecruitment technique that one of the nation's largest engineering employers tried out late last year.

Trying Out a New Concept

An ad in a technical journal caught my eye with its banner headline—A New Concept in Professional Job Selection. Pulled into the text by a promise that I could calculate my probability for success at XYZ Co. in one hour in my own home, I discovered that it's hard to escape the testmakers. Touched with a slight streak of masochism, I clipped the coupon at the bottom of the page, and sent it off to XYZ.

Here's how the recruiting method works: multiple-choice technical tests, developed with the cooperation of the firm's own technical staff, are available for completion on your own time. The tests come with sealed answer sheets and a scoring guide to compare your performance with that of the firm's criterion group. (According to the ad, none of this group had a perfect score.) If you test score stacks up as good or better than that of the group, there's a "high probability of success" for you with the firm. The personnel people, no doubt, hope that if you "pass" you'll apply for a job.

Well, I passed one test—engineering administration—and failed, nay didn't even complete the other—airborne communications.

I got to thinking about the testing when my wife, who has no engineering training, scored as high as I on the first one. How widespread is industrial testing for engineers, particularly in the chemical process industries? And are tests being substituted for the warmer traits of human judgment and guidance?

I found, first of all, that this testing-by-mail method is frowned on by many professional psychologists. As one put it: "This kind of thing [the personality inventory] can be terribly damaging to a person." Asked to amplify his remark, he noted that although the recruiting firm doesn't want to know the test results, the testee is bound to draw some layman's inferences from his score, even if he isn't interested in changing his job. In an extreme, the inferences might

undermine his own judgment of prospects for success and promotion in his current job, or of his job mobility.

What Others Have Said About Tests

W. H. Whyte, Jr., took a jaundiced look at personality testing several years ago in his book, "The Organization Man." In a happy commentary about how to cheat on personality tests, he provided a general guide to feeding the testers the answers they want:

Repeat to yourself:

- a. I loved my father and mother, but my father a little bit more.
 - b. I like things pretty well the way they are.
 - c. I never worry much about anything.
 - d. I don't care for books or music much.
 - e. I love my wife and children.
 - f. I don't let them get in the way of company work.

Whyte noted that these points don't describe the man who will go far in his profession, but if you can't seem to fit this pattern, you may not get the chance to go far.

The critique that Whyte provided seems to have hit a nerve of the professionals. Although the book appeared in 1956, only a few weeks ago a psychologist brought its name up, became defensive about its criticisms. The same psychologist, however, was also defensive about a recent critical article about multiple-choice tests that he hadn't even read. Perhaps the psychologists are automatically wary of more probing from without. But perhaps, too, there is such truth in the public attacks that it makes them uncomfortable.

In any case, it's only fair to report that I uncovered no evidence, in a preliminary investigation, that points to large-scale misuse of testing of engineers in the CPI. One of the largest (and oldest) psychological testing and consulting firms is The Psychological Corp. (New York). The associate director of its industrial division, Dr. William Wilkinson, told me that use of the personality inventory tests is not widespread among chemical companies.

When they are used, they're only a fragment of a much larger program that involves aptitude tests, depth interviewing, supervisors' observations and personnel history. For the most part, they seem to be used then only to help in guidance of men who have gotten in over their heads. The philosophy in this seems to be that it's more economic to salvage an employee who is already loyal to the company and, at least, exposed to the job, than it is to hunt out and train a new man.

But Some Tests Try Talent

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If the personality tests aren't typical of those used for engineers, then which are? More common are those such as the Minnesota Engineering Analogies test that some of you may have taken for admission to graduate school. Used to measure engineering achievement and mathematical reasoning ability, the 50-minute test includes such items as:

"Consider a triode:

Spectators: turnstile::plate current:

(1) cathode; (2) plate; (3) anode; (4) grid." The approved answer is "grid," though I would quibble about the equivalence of "spectators" and "plate current" in the completed analogy.

It's just such quibbling that has led Dr. Banesh Hoffmann, of Queens College, to challenge the multiple-choice-test makers in the March issue of Harper's Magazine. Says he, of another test: "Judging by what has happened in the past when individual questions have been criticized, I believe the test experts might deny that the question was bad. Certainly they would point out that in all the years the test had been in use, nobody else had complained about the question and that, in any case, statistics proved the test to be an excellent instrument for determining who is able to think critically and who is not."

For engineers, there's an important commodity factor that prevents many firms from using any appreciable amount of testing. That factor is the shortage of "the kind of engineers we want." Many chemical companies feel that it's unwise to offend prospective employees with tests. Instead, they rely on the old-fashioned business principles of evaluating a man on his record and his promise. It works, too; they've got you!—WCS

RECRUITING ROUNDELAY

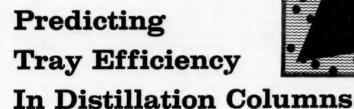
This year, the annual spring rush of recruiting has been paced by a heavier than usual volume of studies of recruiting. And the consensus seems to be forming that industrial firms don't present their best face to prospective employees—a slightly silly practice when trying to attract top-notch engineers.

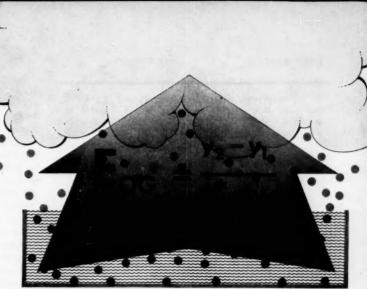
University of Michigan's bureau of industrial relations has just released a study in which 135 recruiting brochures were analyzed. In an era of new frontiers, competition, hard work and long hours were the least frequently mentioned topics in the brochures. And this lack of hard-sell for free enterprise isn't all.

The researchers found that, lacking comprehensive information about a firm, students may not sign up for interviews, may waste interview time with routine questions, may find out they shouldn't be in the interview at all. Result is wasted recruiting dollars in finding the right man.

There's also money wasted in getting experienced engineers. A recent survey by a professional recruitment agency showed that only five or six of 100 firms which were advertising openings tried to establish truly personal relations with job applicants.

Moral: Check your recruiting practice sharply to spend the dollars you have for it more effectively.





Performance of trays as mass transfer devices is one of the factors affecting design. Here is an analysis of tray efficiencies and their effect on column size.

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In distillation columns, we define a theoretical tray as one in which the vapor leaving the tray is in equilibrium with the liquid leaving the tray. This generaally accepted definition is referred to as the Murphree tray efficiency. To evaluate tray efficiency, it is important to remember that a tray is essentially a mass transfer device in which the light components pass from the liquid into the vapor, and the heavy components are transferred from the vapor into the liquid.

Performance of the tray is usually expressed in terms of the transfer of the more-volatile component from the liquid to the vapor in binary systems, or the light key component in multicomponent systems. It should also be recognized that in multicomponent systems, the tray efficiency for other components may not be the same as that for the light key component.

The Murphree tray efficiency is determined by the contact that occurs at a multitude of points on the tray. Let us focus our attention on one of these points such as that shown in Fig. 1. In the figure, vapor is passing through a very thin slice of liquid whose depth is Z. The concentration of the liquid within this slice is x and is assumed constant at all points within the slice for the purpose of simplifying this discussion. Concentration of the liquid in adjacent slices is not necessarily the same as that within the slice under consideration.

We will assume that the vapor rate V remains constant in passing through this element and that the temperature of the liquid in the element is constant. Mole fractions of the light component in the vapor entering and leaving the element are y, and y, respectively. The light component passes from the liquid into the vapor. Thus, the element can be visualized as acting as a small stripping column of height Z. Rate of mass transfer at any depth in this element is:

$$Rate = Vdy \tag{1}$$

Over-all potential difference for the transfer of mass from the liquid may be expressed in terms of either gas concentration units or liquid concentration units. It will be more convenient in this discussion to use gas concentration units as mole fractions. In this set of units, the over-all potential difference is given by:

Potential difference =
$$y^{\bullet} - y$$
 (2)
where y^* is mole fraction of component in vapor that

is in equilibrium with liquid concentration x.

Therefore, the rate of mass transfer at any point is the potential difference divided by the resistance:

$$Vdy = (y^* - y)/R_{OG} \tag{3}$$

where R_{og} is over-all resistance to mass transfer based on gas-phase mole fraction units.

An alternate expression for the rate is:

$$Vdy = K_y aS (y^* - y) dZ$$
 (4)

where:

 $K_{\nu} = \text{Over-all gas transfer coefficient, lb.-mole/(hr.) (sq. ft.)}$ (unit Δy).

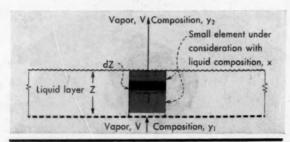
= Ratio, sq. ft. surface area/cu. ft. of element.

= Cross-section area of element, sq. ft.

= Depth of liquid, ft.

Throughout the element under consideration, y^* is

Point conditions on tray-Fig. 1



constant since x and the temperature are assumed constant. This allows Eqs. (3) and (4) to be readily integrated between the limits y_1 and y_2 . Letting dy = -d ($y^* - y$), we find:

$$-\int_{y_1}^{y_2} \frac{d (y^* - y)}{(y^* - y)} = \frac{1}{V R_{OG}} = \frac{K_y aSZ}{V}$$
 (5)

$$\ln\left(\frac{y^*-y_1}{y^*-y_2}\right) = \frac{1}{VR_{OG}} = \frac{K_y \, aSZ}{V} \tag{6}$$

The point efficiency E_{oo} is defined as the ratio of the actual change in concentration of the gas to the change in concentration that would occur if sufficient contact time between the liquid and the vapor were available, so that equilibrium would be established between the liquid and the vapor leaving. Thus, the equation for the point efficiency is:

$$E_{OG} = \frac{y_2 - y_1}{y^* - y_1} \tag{7}$$

Solving Eq. (7) for y_2 , substituting its value in Eq. (6) and rearranging, we get:

$$\ln\left(\frac{1}{1 - E_{OG}}\right) = \frac{1}{VR_{OG}} = \frac{K_{y} \, \text{aSZ}}{V} \tag{8}$$

The right hand side of Eq. (8) is the number of over-all gas transfer units $N_{\sigma\sigma}$, and Eq. (8) becomes:

$$\ln\left(\frac{1}{1-E_{OG}}\right) = N_{OG} = \int_{y_1}^{y_2} \frac{dy}{y^* - y} \tag{9}$$

Thus, the higher the number of transfer units required to effect a given change in the vapor concentration, the lower is the value of the efficiency E_{oo} .

The relation between the resistance R_{og} , the transfer coefficient K_{g} and the number of over-all transfer units N_{og} is found from Eqs. (8) and (9). Making the necessary substitutes and rearranging gives the following equation:

$$\frac{1}{VR_{og}} = \frac{K_y \, aSZ}{V} = N_{og} \tag{10}$$

Eq. (10) also shows that the higher the over-all resistance to transfer, the greater is N_{oo} and consequently the lower is E_{oo} . It is more convenient to use N_{oo} than the expression K_{ν} aSZ/V since the terms a,

S and Z are not easily evaluated for the conditions existing on the tray. In spite of this, we can obtain useful qualitative information by examining these items.

The term a is the transfer area per unit volume of the small element under consideration. This should be related to the size and number of vapor bubbles at this point, or a may be looked upon as reflecting the effect of the degree of vapor dispersion in the liquid.

The product SZ is the volume of the element. The ratio (SZ/V) is, therefore, related to the time of contact for the vapor to pass through the element.

It will be instructive if we take a closer look at the makeup of the transfer coefficient K_{ν} . The over-all potential difference may be considered as made up of two parts; one portion is used to overcome the resistance to transfer imposed by the gas phase and the other is used to overcome the resistance of the liquid phase. We will assume that the resistance of the interface between the gas and liquid phases is negligible. We write the identity:

$$(y^* - y) = (y^* - y_i) + (y_i - y)$$
 (11)

Here, y_i is the mole fraction of the component in the vapor at the interface. The term (y^*-y_i) is the potential difference, expressed in gas-phase concentration units, required for the transfer of mass from the main body of the liquid to the interface. The term (y_i-y) is the potential that is utilized in the transfer of the component from the interface to the main body of the gas. Equilibrium between the gas and the liquid is assumed at the interface. Our rate equation can be written as:

$$Vdy = k_x aS (x - x_i) dZ = k_y aS (y_i - y) dZ$$

= $Ky aS (y^* - y) dZ$ (12)

where

 $k_x = \text{Individual mass transfer coefficient in liquid phase, lb.-$

mole/(hr.) (sq. ft.) (unit Δx). $k_y = \text{Individual mass transfer coefficient in gas phase, lb.-mole/}$ (hr.) (sq. ft.) (unit Δy).

(hr.) (sq. ft.) (unit Δy). x = Mole fraction of component in main body of liquid. $y_i = \text{Mole fraction of component at the interface in the gas.}$

 $y_i = \text{Mole fraction of component at the interface in the gas.}$ $x_i = \text{Mole fraction of component at the interface in the liquid.}$

The relation between the potential $(x-x_i)$ and (y^*-y_i) can be obtained from

$$y^* = mx + b \tag{13}$$

$$y_i = mx_i + b \tag{14}$$

$$m(x - x_i) = (y^* - y_i)$$
 (15)

where m is the slope of the equilibrium line. To simplify this presentation, we will assume that the values of m in Eqs. (13) and (14) are the same. [In reality, this assumption is an approximation, because Eqs. (13) and (14) are the equations of tangents to the equilibrium line.]

From Eq. (12), we obtain:

$$\frac{k_x a (y^* - y_i)}{m} = k_y a (y_i - y) = K_y a (y^* - y)$$
 (16)

Combining Eq. (16) with Eq. (11), we obtain:

$$\frac{1}{K_{y} a} = \frac{m}{k_{x} a} + \frac{1}{k_{y} a} \tag{17}$$

Resistance of the liquid phase R_L and resistance of the gas phase R_a are given by:

$$R_L = \frac{1}{k_x \, aSZ} \tag{18}$$

$$R_G = \frac{1}{k_y \, aSZ} \tag{19}$$

Using these resistances, we can express the relations of Eq. (17) as:

$$R_{OG} = mR_L + R_G$$

$$VR_{OG} = VmR_L + VR_G$$
(20)

$$VR_{OG} = VmR_L + VR_G$$

$$-\frac{1}{\ln(1 - E_{OG})} = VR_{OG} = VmR_L + VR_G$$
 (22)

Instead of resistances, we may use transfer units defined as follows:

$$N_L = \frac{k_x \, aSZ}{L} = \frac{1}{LR_L} \qquad (23)$$

$$N_{G} = \frac{k_{y} \, aSZ}{V} = \frac{1}{VR_{G}} \tag{24}$$

where N_L is number of individual liquid-film mass transfer units based on potential $(x - x_i)$; and N_a is number of individual gas-film mass transfer units based on potential (y, -y). Hence:

$$-\frac{1}{\ln(1 - E_{OG})} = \frac{1}{N_{OG}} = \frac{mV}{LN_L} + \frac{1}{N_G}$$
 (25)

Eqs. (21) through (25) show that the resistances of both phases must be considered, and relate these resistances to the mass transfer coefficients, liquid rate, vapor rate, degree of dispersion as represented by a, time of contact of the gas as related to (SZ/V), time of contact of the liquid as related to (SZ/L). In turn, the mass transfer coefficients are related to the physical properties of the liquid and gas phases, and the flow rates.

Quantitative evaluation of these coefficients is very difficult for contacting devices such as the trays in a distillation column. In our previous article1 on absorption, we showed some typical relations for these coefficients in absorption columns. We can expect the mass transfer coefficients in distillation to be affected by the same factors. Most important of these are: diffusivity of the component in the gas and liquid phases, mass velocity of each phase, viscosity of each phase, temperature and pressure insofar as they affect the physical properties.

Because of the difficulty of quantitative evaluation of these factors separately, we find it more convenient to study E_{og} to express the net effect of all the previously mentioned items on the performance of the tray. However, we must keep in mind the separate quantities that make up E_{og} whenever we study it.

It is possible to define a point efficiency E_{oL} based on the over-all potential difference $(x - x^*)$ where x^* is the concentration the liquid would have if it were allowed to attain equilibrium with the main body of the gas at mole fraction y.

In this article, we will not discuss the efficiency of E_{oL} nor is it necessary because it is largely a matter of convenience as to whether E_{oa} or E_{oL} is used.

Because of space limitations, we will not present a more-detailed discussion of the point efficiency. For a thorough discussion of the subject, see "Bubble Tray Design Manual-Prediction of Fractionation Efficiency," AIChE, New York, 1958. In this manual, we also find a discussion of the extensive research program sponsored by AIChE on the subject of tray efficiency. We will summarize some of the important correlating equations from this manual.

Gas Phase Transfer Units

We can calculate the number of gas phase transfer units from:

$$N_G = (0.776 + 0.116W - 0.290F + 0.0217Q)/(N_{SC})^{0.5}$$
 (26)

(21)

= Weir height, in. = $U_{\sigma} (\rho_{\rho})^{0.5}$ cu. ft./(sec.) (sq. ft. tray bubbling area). = Gas rate, cu. ft./(sec.) (sq. ft. tray bubbling area). = Gas density, lb./cu. ft. = Liquid rate, gal. hot liquid/(min.) (ft. of average liquid flow width). = Gas Schmidt number = $u_{\sigma}/c_{\sigma}D_{\sigma}$

 $N_{SC} = \text{Gas Schmidt number} = \mu_G/\rho_g D_G.$ $\mu_G = \text{Gas viscosity, lb./hr.-ft.}$ $D_G = \text{Diffusivity of component in gas, sq. ft./hr.}$

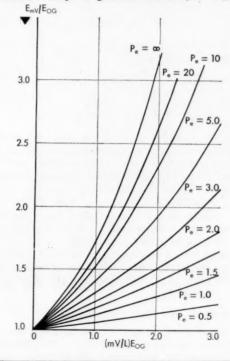
Liquid Phase Transfer Units

For calculating the number of individual transfer units, the design manual gives the following equations where

$$N_L = (1.065 \times 10^4) (D_L)^{0.5} (0.26F + 0.15) t_L$$
 (27)

$$t_L = 37.4 Z_c Z_1/Q (28)$$

Relate tray to point efficiency—Fig. 2



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where the symbols in Eqs. (27) and (28) represent:

 $egin{array}{ll} t_L &= & \mbox{Time of contact of liquid, sec.} \\ D_L &= & \mbox{Diffusivity of component in liquid phase, sq. ft./hr.} \\ Z_s &= & \mbox{Liquid holdup on tray, cu. in./sq. in. of tray bubbling} \\ \end{array}$

area. Z_1 = Length of liquid travel (distance between inlet and out-

Values of Z, are correlated by the equation:

$$Z_* = 1.65 + 0.19W - 0.65F + 0.020Q$$
 (29)

Values of N_a and N_L calculated from Eqs. (26) and (27) are used in Eq. (25) to calculate the point efficiency Eog.

Referring to Eq. (25), research shows that the values of N_L are usually much larger than N_0 . This would tend to make the liquid resistance small compared with the gas phase resistance. In fact, the gas phase resistance is found to be controlling in most cases. On the other hand, the group (mV/L) must also be considered along with N_L. Thus, a high liquidvapor ratio (L/V) would tend to make E_{oo} dependent on N_a rather than N_L . Also, the slope of the equilibrium line m has a marked effect.

For binary mixtures, we may represent the equilibrium line by:

$$y = \frac{\alpha x}{1 + (\alpha - 1) x} \tag{30}$$

By finding the differential of Eq. (30), we obtain the slope m, which is:

$$m = \frac{[y + \alpha (1 - y)]^2}{\alpha} \tag{31}$$

$$m = \frac{\alpha}{[1 + x (\alpha - 1)]^3} \tag{32}$$

Eqs. (31) and (32) show the effect of relative volatility on the slope of the equilibrium line. For a given composition, the higher the relative volatility, the higher is m. Therefore, low relative volatility tends to make E_{aa} more dependent on N_a than N_L . If the relative volatility is low, then a high (L/V) ratio would usually be required to effect the separation. This combination would make (mV/L) low, and consequently tend to make E_{oo} dependent on N_{o} . On the other hand, a high relative volatility would ordinarily require a low (L/V) ratio and this would tend to minimize the effect of N_g and accentuate the effect of N_L on the value of Eog.

Relate Point and Tray Efficiencies

In the discussion thus far, we have confined our attention to the point efficiency E_{oo} . The Murphree tray efficiency E , previously defined, can be related

to E_{og} . The relation depends upon the type of tray action that occurs.

1. The liquid is thoroughly mixed so that its composition is the same at all points on the tray, and the gas phase is also thoroughly mixed. Hence:

$$E_{mV} = E_{OG} \tag{33}$$

2. Liquid is considered as being composed of a large number of elements of differential width. In each element, the liquid is thoroughly mixed and flows across the plate with no mixing between adjacent elements. The equation' that follows assumes complete mixing of the vapor between trays:

$$E_{mV} = \frac{L}{mV} (e^{\theta} - 1) \tag{34}$$

where θ is $(mV/L)E_{og}$.

3. Liquid mixing in this case is intermediate between the two previous cases. The degree of mixing is characterized by the Peclet number, which is:

$$P_* = Z_1^2 / D_B t_L \tag{35}$$

Here, D, represents the eddy diffusion coefficient. The value of D_{π} depends on the spacing of the bubble caps. The research report of the AIChE recommends that for 3-in. round bubble caps on 4.5-in. triangular spacing:

 $(D_E)^{0.5} = 0.0124 + 0.0171U_G + 0.00250Q + 0.0150W$ (36)

For 6.5-in, round caps on 8.75-in, triangular spacing, the relation becomes:

$$(D_E)^{0.8} = 1.154 (0.0124 + 0.0171 U_G + 0.00250Q + 0.0150W)$$
 (37)

The relation between E_{mr} and E_{gg} is complicated and is best shown graphically. A typical graph in which E_{mr}/E_{oo} is plotted vs. $(mV/L)(E_{oo}$ is shown in Fig. 2 for lines of constant Peclet number.

Entrainment and frothing are also items that affect tray efficiency. However, prediction of the occurrence and magnitude is open to question. Consequently, we will not discuss them here.

Relation Between Tray and Column Efficiency

The over-all column efficiency is the ratio of the number of theoretical trays to the number of actual trays required for a given separation. If the equilibrium and operating lines are both straight, then the over-all column efficiency can be calculated from:

$$E_0 = \frac{\ln \left\{1 - E_{mV} \left[(mV/L) - 1 \right] \right\}}{\ln \left(mV/L \right)}$$
(38)

Unfortunately, the equilibrium line in distillation is rarely straight. In this case, the column might be considered as composed of several sections, with the equilibrium line and operating line straight in each section. Values of Eo would be calculated for each section from Eq. (38) and the number of actual plates in the section obtained. The total actual plates would then be the sum of those calculated for the various

For illustrative purposes, the following example taken from the "AIChE Bubble Tray Design Manual" will suffice.

A distillation column containing single-pass bubble

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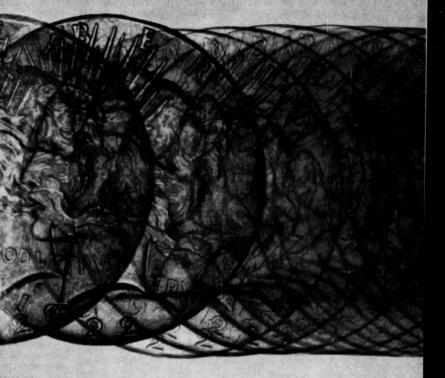
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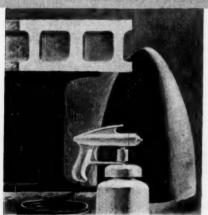
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trays is used to separate n-pentane from n-hexane at a total pressure of 1.25 atm. Overhead temperature is 100 F. and the bottoms temperature is 170 F. Average value of the relative volatility is 2.8. Other data are: weir height, 3 in.; F-factor, 2.0; distance between inlet and outlet weirs, 4 ft.; and average liquid rate, 50 gal./(min.) (ft.).

At a location in the column where (mV/L) is unity: (1.) what is the point efficiency E_{og} ; (2.) what would the Murphree tray efficiency be if the liquid were completely mixed at all points; (3.) what would be the value of E_{mv} for the case in which the liquid flows across the tray without mixing; (4.) what would value of E_{mv} be if the liquid were partially mixed?

To solve this problem, the gas-phase diffusivity D_a , liquid-phase diffusivity D_L , average viscosity of the gas μ_0 and gas density ρ_a are required. At the average column temperature, these are:

 $\begin{array}{l} D_G = 0.097 \; \mathrm{sq. \; ft./hr.} \\ D_L = 2.51 \times 10^{-4} \; \mathrm{sq. \; ft./hr.} \\ \mu_G = 0.0179 \; \mathrm{lb./hr.-ft.} \\ \rho_G = 0.225 \; \mathrm{lb./cu. \; ft.} \end{array}$

The gas phase Schmidt number is $N_{sc}=\mu_a/\rho_s$ D_a or 0.82. Substitution in Eq. (26) gives the value of N_o , which is equal to 1.79.

The liquid density on the trays is 37.7 lb./cu, ft. Using Eq. (29), we find the value of the liquid holdup Z_{ϵ} to be 1.9 in. Then using Eq. (28), the liquid time of contact t_L becomes 5.7 sec.

The number of liquid transfer units N_L is now calculated from Eq. (27).

$$N_L = 6.25$$

In this example, mV/L equals 1.0. Hence, Eq. (25) becomes:

$$-\frac{1}{\ln{(1-E_{OG})}} = \frac{1}{1.79} + \frac{1}{6.25} = 0.719$$

We can now determine the answers to the four questions stated in the problem.

1. Solving the previous equation for E_{og} gives the point efficiency as 75%.

2. If the liquid were completely mixed at all points, the tray efficiency and point efficiency are the same. Hence, $E_{\pi r} = E_{oo} = 75\%$.

3. Where no mixing occurs, Eq. (34) is applicable. Using Eq. (34) with (mV/L) of 1.0 results in a value for E_{mr} of 112%. Comparison of the results in Parts (2) and (3) shows the great importance of a knowledge of the mixing action.

4. In this case, an allowance is to be made for backmixing. We calculate U_a from $F = U_a (\rho_g)^{0.5}$. Hence, U_o is 4.22 cu. ft./sec. The eddy diffusivity D_x is found by substituting in Eq. (36). The value for $(D_E)^{0.5}$ is 0.254. Hence, $D_E = 0.0645$ sq. ft./sec.

The Peclet number is now calculated from Eq. (35) and is found to be 4.35. Using Fig. 2, at a value for $(mV/L)E_{og}$ of 0.75, we read the ratio E_{mv}/E_{og} as 1.27. Hence, we can calculate the tray efficiency E_{mr} to be 1.27×0.75 , or 95%. This efficiency is probably somewhat high because entrainment has not been con-

In this article, we have confined our attention to

tray efficiency. Of course, this is of great importance in column sizing. However, it must be remembered that just as tray efficiency is affected by liquid and vapor rates, so also are such quantities as allowable vapor velocity, cap pressure drop, tray pressure drop, tray spacing, tray hydraulics, tower diameter, liquid capacities and tray layout. We should consider all of these quantities together. For a complete discussion of these, and their influence on column design, see Refs. 3 and 4.

Limitations of Equations

In the "Bubble Tray Design Manual," previously cited, the limitations of Eq. (26) are given as:

The equation for predicting values of N_a was developed from experimentally measured values of E_{σ} for the absorption of ammonia from air with water, and the distillation of acetone-benzene. Test columns had a 2-ft. diameter and a 2-ft. tray spacing. Schmidt number for both systems was about 0.61, although individual terms varied considerably.

Gas rate F-factors ranged from 1.0 to 2.6. Flooding F-factor was 2.8. Liquid rate ranged from 5 to 25 gal./(min.) (ft. of average liquid flow width).

Outlet weir heights were 1 to 5 in. Column pressure was 0.5 to 6 atm. for the acetone-benzene system and 1 atm. for the ammonia-water-air system. Twelve different trays were evaluated using round and tunnel caps. Round caps ranged from 1.5 to 6.5-in. O.D.

Limitations of Eqs. (27), (28) and (29) are also

Correlation equations for predicting N_L values were developed from measured values of E_{ML} for the desorption of oxygen from oxygen-rich water with air, and the distillation of n-pentane-p-xylene. Test columns had a 2-ft. diameter and 2-ft. tray spacing. Also included in the correlation were oxygen desorption data for a 1×4 -ft. bubble tray section.

Oxygen desorption tests were made at 70 F. and 1 atm. with oxygen concentrations in the water averaging 15 ppm. The n-pentane-p-xylene tests were done at about 275 F. and 1 atm. with n-pentane concentrations that averaged 1 mole %.

Gas rate F-factors ranged from 0.2 to 2.3. Priming F-factor was 2.8. Liquid rate ranged up to 25 gal./(min.) (ft. of average liquid-flow width). Liquid rates for oxygen desorption were in excess of 100 gal./(min.) (ft.). Both 1.5 and 3-in. diameter round cap trays were evaluated. Oxygen desorption studies included 6-in. caps and tunnel caps.

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No. 51: Hydraulic Presses

Based on numerous cost quotations from various press manufacturers, some hard-to-come-by data are presented for hydraulic presses, together with information on how to get installed costs.

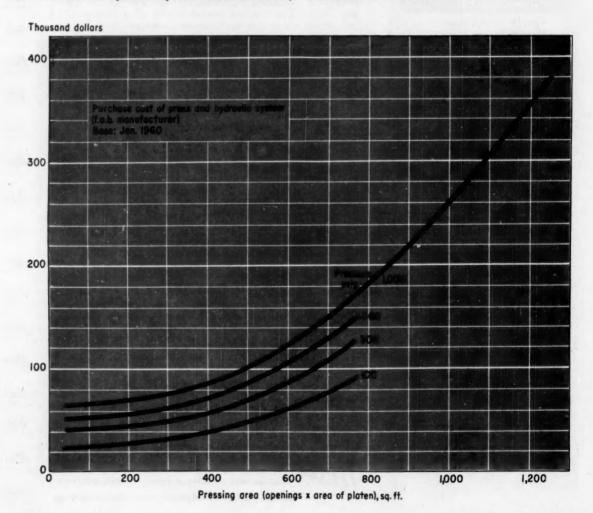
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Cost information on hydraulic presses is particularly scarce in the literature. Yet, such presses are used in many chemical processes.

Data on which the curves below are based were collected from a number of press manufacturers. Costs shown include the hydraulic system with motor drives, but not any installation costs. These installation costs will be 4% of capital costs for large-press systems, 10% for small presses. Foundation costs generally amount to about 10% of press purchase price shown.

The "pressing area" is obtained by multiplying area of a platen by the number of openings.

All cost data are corrected to Jan. 1960, using the Marshall & Stevens average index for all industries. A few quotations from as far back as 1953 were used in plotting the curves, but half of the plotted points were from 1958 and later.





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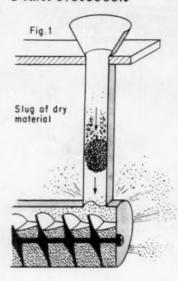
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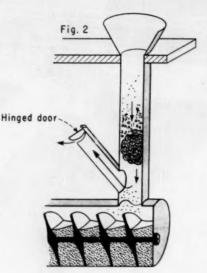


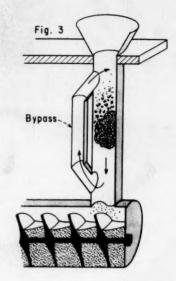
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Plant Notebook







ELIMINATE DUST FROM PISTON EFFECT

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Loading dusty material from bags into a chute can create a piston effect that will force dust through leaks in the system and back up the chute. If the chute feeds a screw conveyor, this effect can even cause enough pressure to fluidize the material and hamper conveyor operation.

Fig. 1 shows how the piston is formed when slugs of material fall down the chute, forcing air before them. The resulting dust causes immediate discomfort to the worker and increases the dust in the air, adding to possible hazard and maintenance problems.

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should seat in a near-vertical position so that it will effect a light seal. The side chute should have an upward tilt of about 60° and be long enough to prevent settling or escape of powder.

Fig. 3 shows an alternate solution to the problema balance line. This method has the advantage of not exhausting outside the system and of having no moving parts. Here, the air forced down by the piston action goes back to the top of the chute and no pressure can build up. The bottom of the balance line should be far enough above the vessel or conveyor that it does not take in dusty air. Although the line will operate satisfactorily with its inlet and outlet at right angles to the chute, it is preferable to have them at a slight angle so that powder will not collect.

UNITIZED INVESTMENTS FOR QUICK UNIT COSTS

G. C. LAMMERS Lakewood, Colo.

Computational shortcuts are of great value even when lacking rigor, especially when the solution can be obtained mentally and is thus available in conferences, on the telephone and in similar situations of tactical importance. A particularly appropriate case is the one where capital investments are stated in thousands of dollars per unit of production per stream day, \$M/(unit/SD). The unit of production can be

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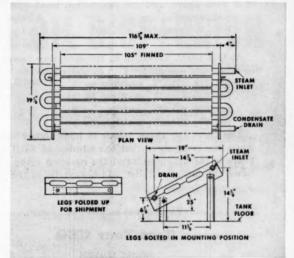
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lbs., gal., or any other unit of quantity, and the stream day is defined as a production day of 24 hr.

Such unitized investments provide quick estimates of the unit costs of production. Consider the case of a 3-yr. payout applied against a \$4 million plant producing 2,000 tons/SD of product at 90% operating factor. The usual calculation for the unit cost of providing the capital would look like this:

$$\left(\frac{4,000,000}{1,000 \times 2,000}\right) \left(\frac{0.333}{0.9 \times 365/1,000}\right) = \$2.03/\text{ton}$$

except for the cancelling factors of 1,000 that I have added to illustrate the derivation of the method. It is apparent that had the investment been expressed in thousands of dollars/(ton/SD), as shown in the first term, multiplying by 1 would yield a close approximation to the correct answer, the type of thing that most of us can perform mentally.

Some managements like to complicate the issue by breaking down their payouts into amortization charges and interest (return) charges. By varying the amortization period, they can account for variations in the obsolescence factor, design uncertainties and the like, leaving the interest rate to indicate the over-all attractiveness. In this case, we can proceed as follows:

5-yr. amortization is equivalent to 0.20/yr. 20% interest (before taxes) is equivalent to 0.10/yr.

Total 0.30/yr.

It's even simpler if your management talks in terms of "after income tax" return, because the roughly 50% tax rate then cancels the time payment factor of 2 used above, and the calculation looks like this:

5-yr. amortization 0.20/yr. 10% interest (after taxes) 0.10/yr.

Total 0.30/yr.

At this point, variation in the operating factor can be taken into account (CY = calendar year):

for 328 SD/CY, multiply by 3

for 300 SD/CY, multiply by 31

for 250 SD/CY, multiply by 4

for 200 SD/CY, multiply by 5

The basis for these values is immediately evident when one remembers that the number of SD/CY appears in the denominator of the equation given above. Since the final multiplier will always be in the order

Test Your CEQ

ROBERT LEMLICH

An icicle is brought indoors at noon and suspended by a thin string from the ceiling of an interior, draftfree room of constant temperature. By 1:00 p.m., the icicle is melting at the instantaneous rate of 0.2 g./ min. and has melted down to 10 g. If the dripping icicle remains suspended, at approximately what time will it be completely melted?

Answer on page 202

of magnitude of 1, finding of the decimal point can usually be bypassed. Values so obtained are not highly accurate and tend to be low by about 10%.

What about other factors such as labor, maintenance, overhead, property taxes, utilities, etc.—everything except raw material costs? Over a period of years, I have tabulated the sum of these costs, along with the unitized investment divided by 1,000, for nearly 50 plants covering a broad range of the process industries. The average ratio was 1. The range, however, ran from 0.4 to 4, with a standard deviation of 0.7. The lower values stemmed from large plants producing basic chemicals, the higher values from small plants producing specialty or fine chemicals. Thus, with some knowledge of the plant in question or some experience with similar plants, your guess on operating costs can be quite close.

There is a tendency for the ratio of operating cost to interest and amortization charges to be constant—near the value of 1. When conditions permit longer amortization periods and lower rates of return, the opportunity is created to re-optimize the process by increasing investment in order to lower operating costs. Secondly, this usually means that the process technology is more mature and cost-cutting refinements have been incorporated into the plants.

Like the plant investment, a unitized investment is applicable only to the size of plant from which it was derived, but extrapolation to other capacities is possible by using the capacity ratio raised to the (1-n) power, where n=0.6, for example.

If you have an estimate of the profit per unit of production, the reciprocal of the payout period is:

1/payout = fractional interest and amortization factor

= (SD/CY) (\$ profit/unit) Investment, \$/(unit/SD)

Thus, if you can make $10\epsilon/lb$. on a plant costing \$250/(lb./SD), the fraction per year is, for 82% operating factor, 300~(0.10)/250~=0.12, or about an 8-yr. payout. Conversely, if a net of $10\epsilon/lb$. has been estimated after deducting all operating and raw-material costs, the operation will sustain an investment of \$100/(lb./SD) with a 3-yr payout, \$200/(lb./SD) with a 6-yr. payout, etc.

Although the numbers are not quite so convenient, a similar scheme can be developed to apply to investments expressed on an annual basis, \$/(unit/yr.). In this case, the annual fractional interest and amortization charges are applied directly (0.333 for a 3-yr. payout), and the remaining costs will, on the average, add another ½ to the cost of manufacture. This method tends to neglect or mask the operating factor, which can be significant in preliminary appraisals.

These rough-and-ready techniques are not highly accurate but do have surprising utility in that the first approximation to unit costs of production is a matter of simple mental arithmetic. If you know nothing about a plant except its costs in \$/(unit/SD), divide by 1,000 and multiply by 2 to get an estimate of what the economists call the "value added by manufacture."



MHI SODIUM HYDRIDE OIL DISPERSION

In addition to this significant time saving, NaH dispersed in oil offers other marked advantages over sodium and sodium alcoholates for acetoacetic ester and related base-catalyzed condensations. Reaction temperature requirements are generally lower. Yields are as much as 32% higher.* On a basis of overall processing cost, NaH has proven its significant advantages.

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Easily handled as a solid, NaH is a dry mealy dispersion of 5-20 micron crystals coated with mineral oil. The oil is a moisture barrier which preserves the activity of the hydride. NaH Advantages Are Important In These Typical Reactions:

Self-Condensation of Esters

 $\begin{array}{c}
O \\
2R-CH_1C-OR'+2 \text{ NaH} \rightarrow
\end{array}$ $\begin{bmatrix}
O \\
R-CH_1-C-CRC-OR'
\end{bmatrix}$ $\begin{array}{c}
O \\
Na \\
\Theta + \text{ NaOR'} + 2H_2
\end{array}$

Alkylation of amides

R-C-NHR' NaH

*Carbethoxylation of Cyclohexanone

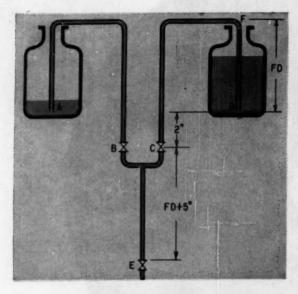
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SAFE SIPHONING OF HAZARDOUS LIQUIDS

M. SIEGEL

Consolidated Refineries, Israel

A frequent problem when handling hazardous liquids in the laboratory is the safe renewal of a siphon. The writer has solved this problem with sulfuric acid by using the simple method illustrated.

While siphon ABE is in operation, the new container D is connected to valve C, which is then opened. The height CE being greater than FD, the suction pressure at C will be sufficient to siphon the liquid from D. Valve C is closed and container D is ready for use when required.

GRAPHICAL METHOD CONVERTS MOLE WEIGHTS

SAMI I. ATALLAH
Tufts University, Medford, Mass.

Several nomographs are available for the conversion of weight fraction to mole fraction and vice versa (see Refs.). Nomographs are not always handy, however, and their use requires a slide rule and/or several construction lines. The simple procedure described here requires only a ruler, pencil and sheet of rectangular graph paper. Baker's method* also employs rectangular graph paper but requires several steps and the use of a slide rule.

First, lay out an abscissa on the graph paper as shown in Fig. 1 and divide it between 0 and 1.0 to indicate weight or mole fraction. From 1.0, construct a vertical ordinate to indicate molecular

weights. Next, join the molecular weights of the two components of the binary mixture under consideration to 0 on the abscissa.

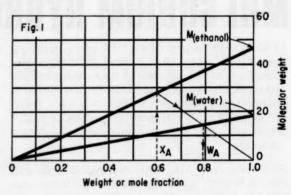
To convert mole fraction x_A of component A to weight fraction w_A , start at x_A on the abscissa and draw a vertical to the line through the molecular weight of A. Connect the point of intersection to x=1.0. At the point of intersection of this line with the line through the molecular weight of component B, drop a vertical to w_A on the abscissa. To convert weight fraction to mole fraction, simply reverse the procedure.

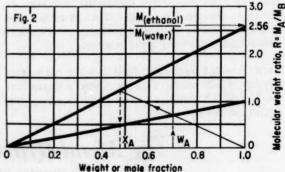
The example shown is an ethanol-water solution with 0.6 mole fraction ethanol. To find weight fraction of ethanol, follow the above procedure with ethanol as component A and water as component B. This gives a weight fraction w_A of 0.793.

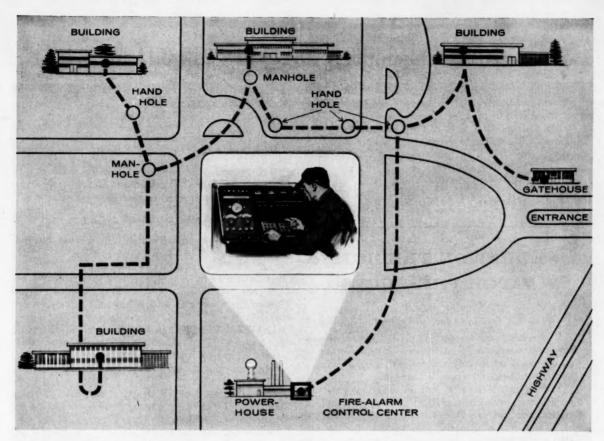
Fig. 2 shows a variation of the method. Here, it is necessary to calculate the ratio of molecular weights of the components. First, draw an abscissa and ordinate as shown. The molecular-weight ratio R is plotted on the ordinate instead of molecular weights. The ordinate points R=1 and $R=M_{A}/M_{B}$ are connected to 0 on the abscissa.

To convert mole fraction to weight fraction, construct a vertical from x_A to the line through M_A/M_B and connect the intersection to x=1.0. Drop a vertical from the intersection with the line R=1, to give w_A on the abscissa. Reverse the procedure to convert from weight to mole fraction.

Again, the example is an ethanol-water mixture,







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this time with an ethanol weight fraction of 0.7. To convert to mole fraction, follow the construction lines on the figure to produce $x_4 = 0.478$.

The mathematical proof of these methods is a simple exercise in coordinate geometry.

Baehr, H. D., Chem. Ing.-Tech, 25, 676 (1953). Baker, J. S., Chem. Eng., 45, 155 (1938). Bridger, G. L., Ibid, 44, 451 (1938). Nord, M., Ibid, 52, No. 8, 116 (1945). Underwood, A. J. V., Trans. AIChE., 10, 145 (1932).

EQUATION PREDICTS VAPOR PRESSURES

JOHN RUDKIN

John and E. Sturge Ltd., Birmingham, England

It is sometimes necessary to predict the vapor pressure-to-temperature relationship (P°/T) for an organic liquid when only the normal boiling point T_{b} and the molecular structure are known.

From a knowledge of T, and the molecular structure, good estimates of the critical pressure P. and the critical temperature Te can be made by the methods of Lydersen¹ and Riedel^{8, 8}. Conventionally, the next step would be to use the normal boiling data and the critical data to construct a reference substance plot (Cox, Othmer) from which the P°/T relationship can be deduced. This method is comparatively lengthy and can be simplified and shortened.

Calingaert and Davise have shown that when water

is used as the reference substance, the plot method is equivalent to assuming that

$$\log P^0 = A - \frac{B}{(T - 43)} \tag{1}$$

where A and B are constants characteristic of the substance.

The normal boiling data and critical data can be used to eliminate the constants A and B (two equations, two unknowns) when the result is

$$\log P^{0} = \frac{(T_{c} - 43) (T - T_{b})}{(T_{c} - T_{b}) (T - 43)} \log P_{c}$$
 (2)

where Po and Po are given in atmospheres for convenience.

The P°/T relationship can now be deduced directly by substitution in Eq. (2), a method that avoids graphical construction and considerably facilitates estimation of the vapor pressure at any particular temperature.

► Example—Eq. (2) has been used to predict data for a typical case assuming only T_b and the molecular structure are known. The substance selected is ethyl acetate and the known data are: molecular weight = 88.1, $T_b = 350.1 \text{ K}.$

The estimated and actual critical data are: T_c (est.) $= 529 \text{ K.}, T_e \text{ (act.)} = 523 \text{ K.}, P_e \text{ (est.)} = 39.5 \text{ atm.},$ P_c (act.) = 37.8 atm.

From Eq. (2)

$$\log P^{0} = \frac{(529 - 43) (T - 350.1)}{(529 - 350.1) (T - 43)} \log 39.5$$
or,
$$\log P^{0} = 4.34 \frac{(T - 350.1)}{(T - 43)}$$
(3)

(continued on following page)

Answer to "Test Your CEQ."

As a convex body that has been melting for some time in uniform surroundings, the icicle will have assumed a nearly constant shape by 1:00 p.m. Further melting will simply decrease its size. Thus, as melting proceeds,

and
$$A \propto L^2 \propto M^{2/3}$$
 (2)

where M is the mass of the icicle and L is any particular characteristic linear dimension, such as length.

Now,
$$q = -\lambda dM/d\tau$$
 (3)

Also,
$$q = hA\Delta t$$
 (4)

For natural convection,
$$h \propto (\Delta t/L)^{1/4}$$
 (5)
Combining all of the above,

$$-\lambda \frac{dM}{d\tau} \propto \frac{(\Delta t)^{1/4}}{M^{1/13}} M^{2/3} \Delta t$$
 (6)

Noting that Δt and λ are constant, proportionality (6) can be written

$$-\frac{dM}{d\tau} = KM^{7/12} \tag{7}$$

where K is a constant. Substituting the given instantaneous data for 1:00 p.m. in Eq. (7) yields

$$K = 0.2 \times 10^{-7/12} \,\mathrm{g}^{.5/12}/\mathrm{min}$$
.

Substituting for K in (7), separating variables and integrating from 1:00 p.m. to the final melting time To, gives

$$\int_{1.00}^{\tau_0} d\tau = -\frac{10^{7/12}}{0.2} \int_{10}^{0} M^{-7/12} dM$$

$$\tau_0 - 1:00 = \frac{10^{7/12} \times 12 \times 10^{5/12}}{0.2 \times 5} = 120 \text{ min.}$$

$$\tau_0 = 3:00 \text{ p.m.}$$
(8)

To test this analysis experimentally, integrate without limits. This yields $M^{5/12} = a_7 + b$

Plotting experimental values of M^{5/12} against τ will then result in a straight line. It is thus unnecessary to run the experiment to complete melting. Best results are obtained with ice that has no holes or concavity and has been melting a while beforehand.

If h did not vary but was constant (as is effectively the case if radiation governs), then the exponent of M in Eq. (7) would be $\frac{2}{3}$, K would be $0.2 \times 10^{-2/3}$ g.^{1/3}/ min. and τ_e would be somewhat later (3:30 p.m.). Because both radiation and convection play a part in the actual melting of an icicle, the final time would really be between 3:00 p.m. and 3:30 p.m.

WHAT'S NEWS IN ENJAY TECHNICAL SERVICE



Enjay helps reduce cost of 90°C vinyl wire insulation...

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The results are compared with experimental values in the table

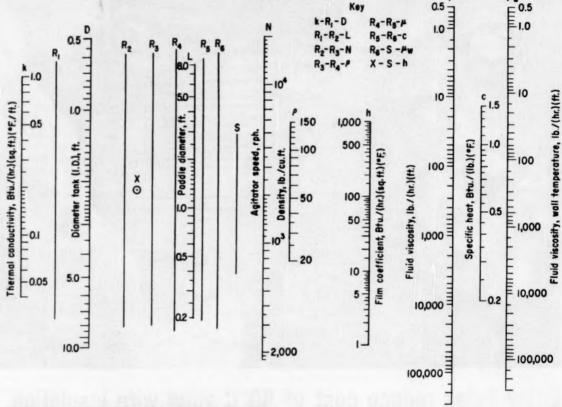
T	V. P., Mm., Eq. (3)	V. P., Mm., Actual
229.6	1.20	1.00
259.5	11.5	10.00
300.0	109.0	100.0
332.3	411	400
373.6	1,540	1,520
442.7	7,760	7,600

Eq. (2) is an even better approximation when actual

critical data are available, and in this case good agreement is found between experimental and predicted vapor pressures for both inorganic and organic liquids.

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 Calingaert, G., D. S. Davis, Ind. Eng. Chem., 17, 1287 (1925).



FILM COEFFICIENTS FOR GLASS-LINED REACTORS

G. M. MACHWART

Michigan College of Mining and Technology, Houghton, Mich.

Over-all heat-transfer coefficients for glass-lined steel reactors are comparable with those of materials having much higher thermal conductivities.1

In Ackley's article,1 a formula is given that is a modification of the customary Sieder-Tate' equation for the liquid film coefficient. The formula is used for liquid film resistances. For standard glassed-steel, three-blade retreat curve impellers, the formula is:

$$h = \frac{0.33 k}{D} \left(\frac{L^2 N_{\rho}}{\mu} \right)^{2/3} \left(\frac{c_{\mu}}{k} \right)^{1/3} \left(\frac{\mu}{\mu_w} \right)^{0.14}$$

The terms are defined in the nomograph.

The nomograph was constructed for the normal limits used and was found to speed up the calculations.

Example-Assume a tank with an I.D. of 10 ft., an agitator diameter of 0.2 ft. and a speed of 50,000 rph. The fluid density is 20 lb./cu. ft. and viscosity is 10 lb./(ft.) (hr.) Viscosity at wall temperature is 1.0 and specific heat is 1.0 and thermal conductivity 0.4.

Following the key, go from k to D, intersecting R_1 . Find R_1 from R_1 and L, and R_2 from R_2 and N. Then find R, from R, and p, and R, from R, and µ. Find R. from R_s and c, and S from R_s and μ_w . The S scale would normally be the answer scale, but a projected scale using point x and the S scale is inserted. A line from point x through the S scale point gives a value of h = 15. The value as given by the formula is 13.4.

References

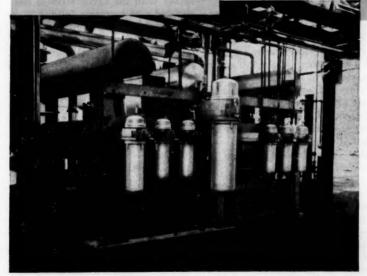
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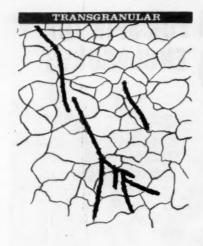
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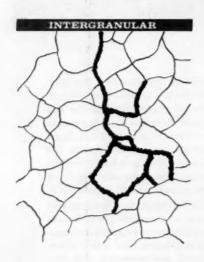


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More Insight on Stress Corrosion





Do you recognize stress-corrosion cracking for what it is? Are you aware of the environments most likely to cause it? Here is a summary of effects of material composition, stress, environment, temperature and time, together with measures you can take to prevent this type of failure.

Although stress-corrosion cracking represents only a relatively small proportion of reported corrosion failures, it is probably more prevalent than is generally assumed. Unfortunately, stress-corrosion failures may often be attributed to other causes. This may result in improper remedial measures, and consequent repeated equipment damage. The special problems of stress-corrosion cracking in copper alloys were covered in a previous Corrosion Forum (Chem. Eng., Feb. 6, 1961, p. 130) but many other metals are subject to this form of attack.

Stress-corrosion cracking is often not recognized for what it is, since little or no general attack may be associated with the failure. Severe cracking is frequently observed in metals that still retain their original bright metallic luster. Even the cracks themselves may show no apparent indication of corrosion.

Nhat Is Stress-Corrosion—Stress-corrosion rather broadly is, "... a form of localized failure which is more severe under the combined action of stress and corrosion than would be expected from the sum of the individual effects of stress and corrosion acting alone. It is characterized by a brittle-type fracture in an otherwise ductile material. The surface direction of the cracks is perpendicular to the direction of the stress load."

Stress-corrosion cracking is often confused with intergranular corrosion. As the name suggests, the latter form of attack follows the grain boundaries of the metal, and is not related to stress. On the other hand, although the attack resulting from stress-corrosion cracking often follows grain boundaries, it is related to the stress pattern in the metal and will sometimes cross grains rather than follow the boundaries.

When a material is repeatedly flexed in a corrosive environment, it may fail due to "corrosion fatigue." This also should not be confused with stress-corrosion cracking, which involves static stresses rather than the cyclic stresses associated with corrosion fatigue.

► Causes—Stress-corrosion cracking results from the interplay of a number of factors, which include:

- · Alloy composition.
- · Tensile stress.
- · Corrosive environment.
- · Temperature.
- · Time.

The way in which some of these factors tend to influence stress-corrosion cracking is illustrated diagrammatically in Fig. 1.

It is believed that pure metals do not crack from stress corrosion; alloys made from pure metals may crack. Alloys made from extremely pure metals are superior to those made from less-pure metals. Highpurity stainless steels are a good example. Certain alloys of a given base-metal system are more resistant to cracking than others. In

This article is based on "Stress-Corrosion Cracking—A Nontechnical Introduction to the Problem," by Warren E. Berry, Defense Metals Information Center, Battelle Memorial Institute, Columbus 1, Ohio. DMIC Report 144, Jan. 6, 1961. Available from Office of Technical Services, Dept. of Commerce, Washington 25, D. C. (Order OTS PB 151104.)

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YOU'LL SEE WHY DURCO SLEEVELINE® VALVES ARE 5 WAYS BETTER

1.

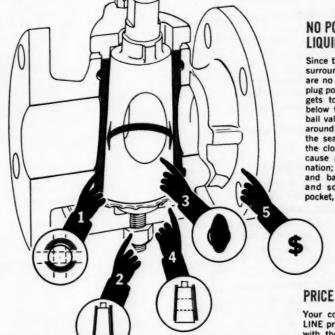
LARGER SEALING AREA

A continuous Teflon* sleeve surrounds the SLEEVELINE plug. This assures positive shut-off even after wear caused by slurries or hard-to-hold corrosive liquids. SLEEVELINE VALVES SEAL AFTER EVERY TURN. Ball valves have two seal rings with a minimum sealing area (almost line contact). Wear and erosion of the seals or roughness of the ball can quickly cause leak-through, *Teflon is a du Pont Company registered trademark.

2.

BETTER ADJUSTMENT EXTENDS SERVICE LIFE

SLEEVELINE valves have up to \(^1\lambda''\), vertical adjustment for seal wear, providing extended service life. Some ball valves have no adjustment for wear, while others require removal from the line or have limited adjustment,



4.

NO POCKET TO COLLECT LIQUIDS AND SOLIDS

Since the SLEEVELINE plug is surrounded by Teflon, there are no pockets into which the plug ports can drain. No Liquid gets to the body around or below the plug. The ports in ball valves drain into a pocket around the ball and between the seals when the ball is in the closed position. This can cause process fluid contamination; corrosion of the body and ball by stagnant liquid; and solids build-up in the pocket, creating seal failures.

5

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Your comparison of SLEEVE-LINE prices and performances with those of other types of valves is also suggested. Write for Durco Bulletin V/14

3.

LARGER AREA OF THE PORT OPENINGS

Nominal Pipe Size	Full Pipe Area in?	Typical Ball Valve area in?	Typical Ball Valve % Port opening	Burco area in?	% Port Opening
1/2"	0.196	0.150	77	0.196	100
3/4"	0.442	0.248	56	0.441	100
1"	0.785	0.518	66	0.785	100
11/2"	1.767	1.227	69	1.150	65
2"	3.142	1.767	56	1.960	63
3"	7.068	4.430	63	3.800	54
4"	12.566	7.669	61	7.100	56
6"	28.274	15.465	55	17.000	60

Flow capacity is sometimes cited as a selling feature for ball valves. Compare some typical ball valve port openings with those of DURCO SLEEVELINE valves.

THE DURIRON COMPANY, INC., SERVES THE PROCESS INDUSTRIES FROM DAYTON, OHIO

DURCO

copper- aluminum- or magnesium-base alloys, cracking resistance improves as the alloy content is reduced and the composition approaches that of the pure metal. Stress—Tensile stresses, at the surface of the metal, are an essential factor in stress-corrosion cracking. Cracking has never been found in metals under compression. These surface tensile stresses may result from internal strains in the material, or may be caused by an applied external load.

Some causes of internal or residual stresses are:

- Metal deformation near welds, rivets or bolts.
- Deformation caused by press or shrink fits.
- Unequal cooling from high temperatures.
- Volume changes in the material caused by phase change or rearrangement of crystal structure.

Applied external stresses may be caused by:

- Differential thermal expansion.
 - · Dead loading.
 - · Pressure differentials.

Residual and applied stresses are additive; to evaluate the effect on cracking, both must be known.

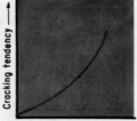
► Environment — Stress-corrosion cracking, of course, requires a corrosive environment. Alloys and environments that may combine to cause cracking are listed in the accompanying table. Although cracking most often occurs in aqueous media, other environments must be considered. Cracking failures of brass in mercury, steel in molten zinc, or stainless steel and titanium

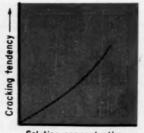
Corrosive environments that cause stress-corrosion cracking in alloys

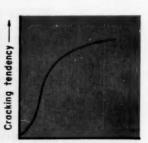
(I = intergranular, T = transgranular cracking)

	Carbon, Low- Alloy Steel	Chro- mium Stain- less Steel	Auster itic Stain- less Steel	Al			Mg Alloys	Ni Alloys	Ti Alloys
NaCl Chlorides Fluorides Bromides Iodides		[T				T		I ⁴
HCl. HF HBr.							T	I	
Caustics	I		TI		I ²			I	
Nitrates. Fuming red HNO HNO ₃ . Ammonia Ammoniated organics.	I				i				I
HCN									
FeCl ₂ , FeCl ₃			1			I			
Sea-coast atmosphere Industrial atmosphere Tropical atmosphere	I ¹	I ¹							
Mercury HgNO ₃ Molten zinc					I				
Molten cadmium.									I
Water and steam. H ₂ S	TT	I		I	I ²		I		
H ₂ SO ₄ -HNO ₅ H ₂ SO ₄ Fluosilicic acid	I		. I		I2				







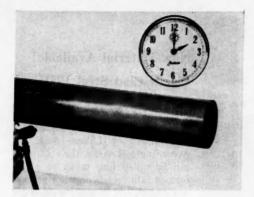


tress level — Temperature -

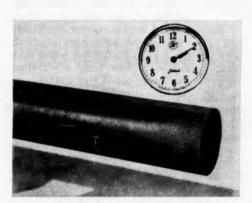
Solution concentration -

Time ---

The way stress, temperature, solution concentration and time influence cracking tendency .-- (Fig. 1)



Only one spray coat of Dimetcote No. 4 is required. No primer! No curing solution!



Dimetcote No. 4 self-cures in a matter of minutes. Completely non-flammable and non-hazardous both during and after application. All the proven corrosion protection and weather resistance of Dimetcote No. 3 — plus self-curing.

As soon as dry, Dimetcote can be handled the same as bare steel. If severe abuse should cause minor abrasions, the zinc content cathodically prevents rust.

Dimetcote is now SELF-CURING!

Dimetcote No. 4 is a self-curing maintenance version of Dimetcote No. 3, the original inorganic zinc silicate coating in use since 1938,

- The 1-coat 100% inorganic zinc silicate that is equal or superior to galvanizing
- · Completely self-curing
- Non-flammable, non-hazardous both during and after application
- Excellent abrasion resistance and toughness
- Cathodically protects steel
- Insoluble in all petroleum products

The dry film of Dimetcote No. 4 is the same as Dimetcote No. 3, which is the most widely used and most successful coating of its kind. Used alone or as a permanent primer, Dimetcote No. 4 gives steel structures the same long-lasting protection against severe atmospheric exposure!

Technical data available on request.

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AMERCOAT NO. 99

When required for severe chemical exposures, Dimetcote plus Amercoat No. 99 provides a revolutionary 2-COAT system! Amercoat No. 99 is a high solids vinyl that easily attains a 6-mil dry film thickness in one airless spray coat . . . a 5-mil thickness in two coats by conventional spray me-

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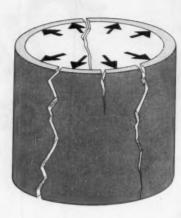
a 5-mil thickness in two coats by conventional spray methods; forms a tough, flexible film with excellent chemical and weather resistance.

Tests prove the Dimetcote/
American No. 99 two-coat
combination outperforms
other maintenance systems—
even those requiring up to 5

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Cracking is perpendicular to direction of stress load .-- (Fig. 2)

in molten chloride may all be considered examples of stress-corrosion cracking.

▶ How to Detect — Some cracks may be visible to the naked eye and thus require no special detection means. Others may be seen after surface deposits are removed, particularly under low-power magnification. Various commercially available crack-detection methods may be used, including magnetic particles, dye penetrants, ultrasonic and eddy-current apparatus.

Avoiding Stress-Corrosion Cracking — It was pointed out earlier that cracking is the result of the interaction of a number of variables. As many as possible of these variables should be adjusted so as to minimize cracking. First, of course, a resistant material should be selected. The table shows some materials to avoid.

Tensile stresses may often be eliminated by changes in design. Operating pressures may be lowered, misalignment of connections avoided, differential thermal expansion prevented, etc. Increasing the metal thickness of thin sections will help in lowering the applied stresses by distributing them over a larger cross-sectional area.

But increasing the metal thickness doesn't decrease residual stresses. One way to do this is by a stress-relief anneal after fabrication. Even if the piece is too large for such an operation, certain critical areas, such as welds, may be relieved. Another way to reduce residual tensile stress is to put the surface layers of the metal into compression. This may be done by shot peening, tumbling, rolling, swaging or stretching. However, such treatment may lose effectiveness if the compressed surface layer is lost due to corrosion.

► Change Environment—It may be possible in some cases to remove the corrosive environment. For example, elimination of chloride ions from solution (by ion exchange) may permit the use of stainless steels in high-temperature water. Or it may be possible to lower the concentration. For instance, concentrated solution can be introduced into the center of a mass of liquid so that it will be diluted before it reaches the walls of the vessel. Similarly, placing heaters in the bulk of the liquid rather than near the walls will prevent concentration of the fluid in relatively stagnant areas. Lowering the temperature of the solution may help minimize cracking, but this is often prevented by process considerations. However, local overheating may be eliminated by using larger. cooler heat-exchange surfaces.

Other ways to help prevent stress-corrosion cracking are by cathodic protection or protective coatings.

Stress-corrosion can be prevented by engineers who are aware of the problem and willing to take the necessary steps.

New Material Available: Plastic-Clad Steel Plate

Polyvinyl chloride plastic-clad steel plate is a newly announced development by Lukens Steel Co. According to Lukens, the clad plate can be rolled into tanks or pipes, formed into vessels or other process equipment, and is easily welded for fabrication. Welds must be recoated by the manufacturer.

Tested, but still commercially untried, the new material is being plugged by Lukens for equipment used in the production of fresh water from saline. Salt water isn't easy to handle from a corrosion standpoint (ex-sailors will remember the almost endless rust-chipping that goes on aboard seagoing vessels) and a saline water conversion plant must handle an enormous volume, much of it more concentrated than normal sea water. In a similar vein, Lukens suggests the clad steel for hulls of yachts, and interiors of swimming pools.

The steel is expected to have a number of uses in the petrochemical field and where contamination or discoloration might be a factor in storage tanks or vessels.

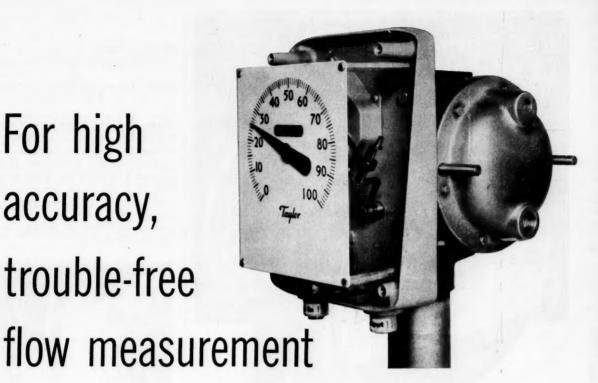
A plastic-clad sheet steel has been manufactured before, but plastic bonded to *plate* has not been previously available.

Incidentally, 30 years ago, Lukens was the pioneer in the manufacture of steel clad with other corrosion-resistant metals.



Plastic bond defies hairpin bending

For high accuracy, trouble-free



Taylor TRANSCOPE® Differential Pressure Transmitter with Barton Meter Body



The new Taylor 210T DP Transmitter features a big 113/4"-long scale that can be read up to 35 ft. away. A lowcost, motion-balance pneumatic transmitter, its transmitted signal is accurate within 1/2% of the input

signal. Threshold sensitivity is 0.1%. Indication is within ±1% of full scale. Weatherproof case has special baked epoxy resin finish on die-cast aluminum. Measures only 7" x 9" x 4". Housing is split diagonally to make adjustments easily accessible. Single-package pneumatics and encapsulated movement are easily removed and replaced for on-the-job maintenance.



The Barton Meter Body is an accurate and reliable aneroid sensing element, designed to measure differential pressure under the most severe operating conditions. Liquid-filled rupture-proof bellows provides built-in over-

range protection. Differential ranges are available from 0-20" water to 50 psi. Housing materials include Cast Aluminum, Forged Steel, Forged 316 Stainless Steel, Forged Alloy Steel 4140 and Forged Type 329 Stainless Steel. Safe working pressures range from 1000 to 6000 psi.

Ask your Taylor Field Engineer, or write for Bulletin 98385. Taylor Instrument Companies, Rochester, N. Y., or Toronto, Ontario.

Taylor Instruments MEAN ACCURACY FIRST



Chemlon Multi-Filament Yarn Packing gives you two important advantages not provided by other types of braided or molded Teffon packing: (1) positive sealing efficiency at high peripheral speeds; (2) a cooler running stuffing box under severe service conditions.

It can be used to handle the most destructive acids, alkalis or solvents. The excellent thermal properties of Teflon, combined with the softness, resiliency and fluid retentive properties of fine fiber construction, adapt it to high temperature conditions to +400°F. and peripheral speeds up to 1000 fpm. The packing is made firm and dense by means of a special process which eliminates large voids.

HERE'S PERFORMANCE PROOF:—Fluid handled: 45% H₂SO₄ (impure) at 170°F. Operating conditions: 1¼" pump shaft at 1700 rpm. or 55 fpm. peripheral speed. Result: 46 days good service. Previous best service record 7 to 10 days.

Chemlon Yarn Packing is available in spool or coil form in a wide range of sizes from \%" up. Style,C-45 is surface-lubricated with Teflon suspensoid, while Style C-30 contains no lubrication.

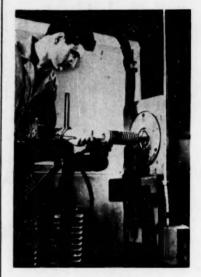
Send for Bulletins Nos. P-321 and P-325. Crane Packing Company, 6451 Oakton Street, Morton Grove, Ill. (Chicago Suburb). In Canada: Crane Packing Company, Ltd., Hamilton, Ont.



CPI NEWS BRIEFS . . . (continued from page 138)

needs of a second oxidation plant that the latter firm is building.

Texas Eastern Transmission Corp. has started mining a 150,000-bbl. underground storage cavern for propane at the Little Big Inch pipeline terminal at Princeton, Ind. It is due to be completed in time for the 1961-1962 propane season, will serve southeastern Illinois, southwestern Indiana and northern Kentucky.



Chase Brass & Copper Co., Waterbury, Conn., announces it is engaged in the first commercial production of rhenium-molybdenum alloys. Combining high strength, refractory characteristics and good ductility, these materials are expected to find use in fields including aeronautics and electronics.

Part of the production process is shown above; operator is inserting an alloy rod into a swaging machine, the entrance of which is equipped with a high-frequency heating coil.

Pittsburgh Chemical Co.'s Industrial Chemicals Div. has gone on stream with a 20-million-lb./yr. maleic anhydride plant at Neville Island, Pa. Raw-material benzene to the unit is available from coke ovens of the company's parent firm, Pittsburgh Coke & Chemical

Co., and byproduct liquor from the maleic operation will be used by Pittsburgh Chemical's fumaric acid plant at the same location.

International Paper Co. will carry out a \$3.5-million expansion program for its mill at Moss Point, Miss. New items will include a 140,000-sq.-ft. storage area for paper products, and a finishing room; company will also modernize the mill's power plant.

The Bunker Hill Co. is now producing wet-process phosphoric acid in a \$2-million plant at Kellogg, Ida. The facility, having an initial capacity of 130 tons/day, was completed last June, but startup was delayed for several months by a strike. Plant design was by Dorr-Oliver, Inc., Stamford, Conn.

Also at Bunker Hill's plantsite, Collier Carbon & Chemical Corp., Los Angeles, has completed separate facilities in which the former company will produce a highly concentrated wet-process acid for Collier. Product is known as Anhydrous Liquid Phosphate, or ALP.

Linde, Co., Div. of Union Carbide Corp., is building an acetylene plant at Pueblo, Colo., primarily to supply Colorado Fuel & Iron Corp.'s operations in that city. Due completed near the end of April, it will have a capacity of 1.5 million cu. ft./mo. Part of the output will go to other acetylene users in the Rocky Mountain area.

Industrial Biochemicals, Inc. has established office, research, and production facilities at the Edison Industrial Center, Edison, N. J. Company is about to introduce a series of specialty biochemical products made via fermentation routes. It will also develop and custom-produce fermentation chemicals for other firms.

W. R. Grace & Co.'s Davison Chemical Div. has expanded and modernized its phosphate-rock mining operation at Ridgewood, Fla. Move followed company's closing of a mine near Lakeland, Fla., and part

A significant new announcement ...

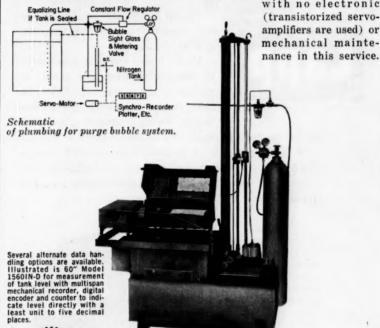
Precision Measurement of Any Liquid

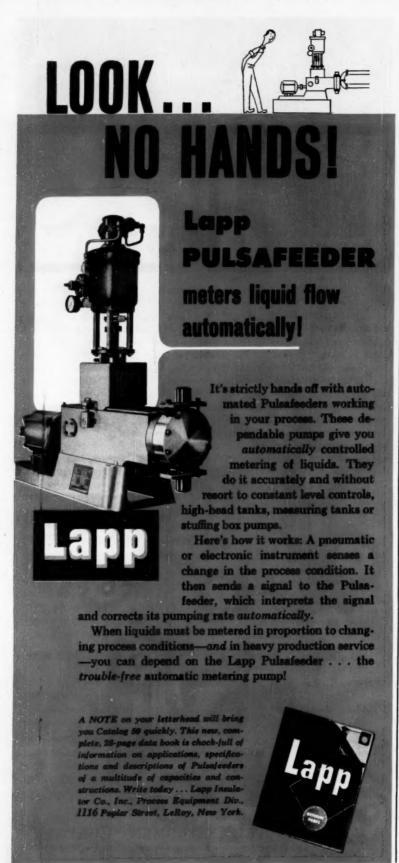




■ This technique has proven to be of remarkable accuracy, utility and reliability-with any liquid; water, high-temperature products, petroleum derivatives, radio-active materials, the most active chemicals and molten metals. Combination of the Exactel Servomanometer with the purge bubbler principle is resolving problem measurement situations. The technique is relatively new but thoroughly proven over the past three years. The process is one of weighing, rather than sensing surface level. Errors caused by temperature change, absorbed gases, etc., are eliminated. For this purpose the Servomanometers generally employ 32" or 60" Hg range, but other liquids or other ranges may be used.

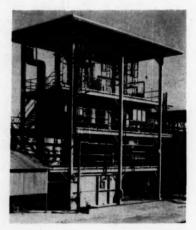
The instrument's accuracies are such that systems now in use have been readily approved for billing purposes; so accurate, in fact, as to practically defy calibration. systems are simple, reliable and economical. Except for minor lubrication and tube-cistern cleaning at approximately annual intervals, Exactel Tank Gaging systems are expected to provide 70 to 100 thousand hours of service with no electronic





CPI NEWS BRIEFS . . .

of the program consisted of transplanting draglines, flotation and other beneficiation equipment from Lakeland to Ridgewood.



Diamond Alkali Co. is producing semicommercial quantities of isophthaloyl and terephthaloyl chlorides at a new plant in Greens Bayou, Tex. Facility, pictured above, turns out the products as high-purity flakes.

Monsanto Chemical Co.'s Plastics Div. is boosting by 30% the capacity of its Texas City, Tex., highpressure-polyethylene plant. Construction is now under way, with completion scheduled for early '62.

Offices

Humble Oil & Refining Co. expects that the headquarters of its Marine Div. will have been completely relocated from New York to Houston by early spring. Division is in charge of a Humble fleet of 24 tankers operating under the American flag, as well as inland waterways operations.

Food Machinery & Chemical Corp.'s Becco Chemical Div. has begun making deliveries from a new distribution center in Villa Park, Ill., about 10 mi. west of Chicago. Occupying a 6-acre site, the center includes a 120 x 100-ft. warehouse and a 75 x 30-ft. office. It handles Becco's hydrogen per-

oxide and other active-oxygen chemicals.

Commercial Solvents Corp. has opened a West Coast office at Agnew, near San Jose, Calif., to serve as a sales headquarters for accounts in animal nutrition products and industrial, agricultural and pharmaceutical chemicals. Company also operates a manufacturing plant at Agnew, which produces formaldehyde, pentaerythritol, metaldehyde (a polymer of acetaldehyde) and ethyl formate.

Robbins & Myers, Inc.'s Moyno Pump Div. has opened a branch office at Pico Rivera, Calif.

Companies

United Nuclear Corp. is the name of a new \$25-million firm planned as a joint venture by Olin Mathieson Chemical Corp., Nuclear Development Corp. of America and Mallinckrodt Chemical Works, with OM initially to be majority shareholder. Company will be an integrated nuclear service organization for commercial and government customers; among its activities will be research and development, reactor system design, and the manufacture of nuclear fuel materials.

Union Oil Co. of California will acquire from Pacific Chemical & Fertilizer Co., Honolulu, Hawaii, the latter firm's factory site in that city and its stock in its wholly owned subsidiary, Pacific Guano Co. PC&F stockholders have approved Union's offer of \$6.5 million. Union will use the Honolulu site for future expansion, and the California firm's subsidiary, Collier Carbon & Chemical Co., will operate Pacific Guano.

J. R. Simplot Co., Boise, Ida., has purchased the treble superphosphate and ammonium phosphate operations of Anaconda Co., located at Anaconda, Mont. Simplot will move the plant facilities by



Where corrosion becomes prohibitively expensive — in high replacement costs, costly production downtime or contaminated product — it's time to investigate du Verre.

Tanks, ducts, hoods, stacks and other process equipment fabricated by du Verre of reinforced Resin Bonded Fiberglass, exhibit excellent resistance to both corrosion and erosion. They are many times lighter than steel, thus reducing freight, erection and supporting steel costs. du Verre has a smooth surface that improves flow characteristics and minimizes build-up of solids on interior surfaces.

Not a coating or lining, du Verre is a completely homogeneous reinforced lamination — uniformly corrosion-resistant inside and out. It can be fabricated to your special shape, size and process requirements.

Write today for Bulletin No. 101 and see how du Verre fabrications could be sparing you the high costs of corrosion.

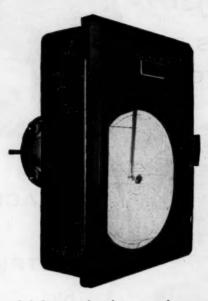


First in Quality for Complete Corrosion Control with Reinforced Plastics

BOX 37-A . ARCADE, NEW YORK

PLANTS IN ARCADE, NEW YORK . ATLANTIC BEACH, FLORIDA

THE FLOW RECORDER YOU CAN COUNT ON



Absolute dependability, under the most demanding operating environments—that's the promise and the performance of the Barton 202A flow recorder. Thoroughly proven in the gas production fields, the 202A is enjoying ever-increasing popularity in gas transmission and distribution systems. It is compact and ruggedly built, not subject to the usual frailties of such a precise instrument; it has built-in overrange protection, and it is immune to condensate problems, making it ideal for application in all geographical areas. A recently added bonus: the 202A can be fitted with the new Barton chart changer which allows the instrument to record continuously and unattended, for up to 16 days, using a fresh chart each day. For complete information and specifications on the 202A flow recorder, request Bulletin 202A-1.



RECORDER-INTEGRATORS/CONTROLLERS/DIFFERENTIAL PRESSURE INDICATORS/PNEUMATIC TRANSMITTERS/FLOW SWITCHES

BARTON INSTRUMENT CORPORATION . MONTEREY PARK, CALIFORNIA

CPI NEWS BRIEFS . . .

rail and truck to Pocatello, Ida., where the firm operates a phosphatic fertilizer complex. The relocated equipment will increase over-all output at the Pocatello works by 80-100%.

Food Machinery & Chemical Corp. has purchased Port Fertilizer & Chemical Co., Los Fresnos, Tex. Latter firm produces pesticides and fertilizers, will operate in association with FMC's Niagara Chemical Div., which manufactures agricultural chemicals. FMC has also acquired Port Chemical Co., Elsa, Tex.

Industrial Appraisal Engineers is a new Houston company that specializes in appraisal of chemical process plants on the Gulf Coast. Firm offers its services to both taxing authorities and industrial companies.

John Deere Chemical Co., Pryor, Okla., has acquired the mixed-fertilizer facilities of Ozark-Mahoning Co., which consist of phosphoric acid and ammonium phosphate plants near Tulsa, Okla. Ozark-Mahoning will continue to own an adjacent sulfuric acid unit, as well as mining operations throughout the U.S.

Studebaker-Packard Corp. has acquired Chemical Compounds, Inc., St. Joseph, Mo. Latter firm processes and distributes additives for motor oil and fuel. It will operate as a division of Studebaker-Packard.

F. J. Stokes Corp., Philadelphia, has established a British subsidiary, F. J. Stokes Ltd., to conduct manufacture and sales of the firm's machinery for the plastics, chemical, automotive and other industries. Marketing will be throughout the British Isles, the British Commonwealth and countries of the European Free Trade Association.

Science Management Corp., Denver, is a new firm that serves small businesses in the electronic, chemical, nuclear and other fields by negotiating needed capital for

"We need valves for rugged, continuous operation."

"We need valves that will reduce maintenance and replacement costs." "We need valves for our severe high temperaturepressure applications."



The answer to all 3 is OIC

FORGED STEEL VALVES

Key men . . . responsible for maintaining continuous production with minimum downtime . . . know the importance of valve performance!

That's why OIC, with years of experience in the chemical and petroleum industries, developed a complete line of forged steel valves for rugged service in high temperature-pressure applications.

Available for operation on all lines up to 2inches, OIC forged steel valves are designed to meet your control requirements with minimum replacement and maintenance cost. Consult your local OIC distributor today. He can help you select the exact valve you need.



Bronze, Iron, Forged Steel, Cast Steel and Ductile Iron Valves

THE OHIO INJECTOR COMPANY . WADS

WADSWORTH, OHIO



Available with trims to service most applications, and with socket weld, flange and screwed end connections.

FORGED	STEEL	VALVES	
Name			

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Company

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BETTER VALVES AND BETTER DISTRIBUTOR SERVICE FROM OIC

With this new Varea-meter external clamp



NOTHING UNSEATS ROTAMETER TUBES.

One big benefit you get from Wallace & Tiernan'snew Varea-meter line is dependable tube clamping. Tubes can't vibrate loose; can't be dislodged, even by sudden flow surges.

A simple but effective lever-type clamp gives a positive tube-locking force.

But for all its holding power, this force is easily controlled. You release tubes by loosening a single bolt . . . change capacities or remove tubes for cleaning in seconds.

There is no paeking; O-rings give positive sealing. There are no springs; the tube is locked by the lever-type clamp. Because this clamp applies force externally, there is nothing in the flow path to clog your meter or corrode.

Teflon or Penton O-rings and tube adapters, and a wide choice of end-fitting materials, allow you to measure highly corrosive chemicals.

W&T Varea-meters come in 36" to 3" tube sizes with 5" or 10" scales. Electric or pneumatic transmitters and other accessories are available. Vareameters conform to ISA Recommended Practice.

For more information, write Dept. V-4.29.





CPI NEWS BRIEFS . . .

them and providing other managerial assistance.

International

India's industrial picture is being widened by recently announced fertilizers developments.

Two U.S. firms—International Minerals & Chemical Corp. and California Chemical Co. — and India's E. I. D. Parry Group have been granted a license by that country to build a \$51-million chemical fertilizers plant on India's east coast, tentatively at Visaj. Companies will make their final decision on participation after completing feasibility studies. Annual capacity would be 350,000 tons, and the plant would be on stream by 1963.

Prime contract for design, engineering and construction of India's third state-owned fertilizer plant has been awarded to Chemical Construction Corp., New York. Facility will be located at Trombay, will produce 90,000 tons/yr. nitrogen, urea and nitrophosphates. Feedstock will be naphtha and gas supplied from nearby oil refineries.

And the country's second stateowned fertilizer plant has gone on stream at Nangal, Punjab. Initial production has been in calcium ammonium nitrate. A temporary shortage of electric power has limited output to 300 tons/day, but ultimate capacity of the \$60million facility will be 1,200 tons/ day.

England's Imperial Chemical Industries Ltd. is undertaking several projects that will increase its domestic capital investment. Company plans to double capacity of a new polypropylene unit at Wilton, Yorkshire, which came on stream late last year with a production capability of 11,000 long tons/yr. Project will be handled by Constructors John Brown Ltd., is due completed within the next 17 months.

Company is upping its polyvinyl chloride production capacity by over 40%, by building a new plant

at Blackpool. It will also increase its capability for making alkylamines at Billingham by erecting a methylamines plant (replacing an existing facility one fifth as large) and doubling the capacity of an ethylamines unit.

Finland: OY Hercofinn AB is a new company formed by Hercules Powder Co., Wilmington, Del., to manufacture chemicals in Finland for that country's paper industry. Main offices will be in Helsinki and a plant will be built at Tampere. Latter is due on stream the first quarter of next year.

Canada: Western Leaseholds Ltd., subsidiary of Canadian Fina Oil Ltd., will operate a \$6-million natural-gas processing plant that is being built in the Wildcat Hills gas field, about 35 mi. northwest of Calgary, Alta. Scheduled for completion in December, facility will be able to process about 97 million cu. ft./day of raw gas, yielding maximum outputs of about 80 million cu. ft./day sales gas, 1.000 bbl./day of condensate and 120 long tons/day of sulfur. Initially, it will operate at slightly over one half of this capacity.

West Germany: Pigment-Chemie GmbH., Cologne, is constructing a titanium dioxide plant at Homberg. Initial capacity will be about 18,000 tons/yr. but the facility is not expected on stream until next spring at the earliest. Pigment-Chemie is a joint subsidiary of Sachtleben AG fur Bergbau und Chemische Industrie and the U.S. firm. Du Pont.

Canada: Mattagami Lake Mines Ltd. will build eastern Canada's first zinc refinery at Valleyfield, Que. Plant will cost \$30 million, will produce 165,000 tons/yr.

Portugal: Uniao Fabril do Azoto will erect a fertilizer complex at Lavraido, near Lisbon. Due completed next year, it will include a 180-metric-ton/day ammonia plant, a 40,500-metric-ton/yr. urea unit, and plants to make nitric acid, ammonium nitrate and nitro-limestone.

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BULLETIN G-30—Describes the DAY Type "RJ" filter. An all purpose, versatile unit. Bulletin gives operating features, dimensions and specifications.

BULLETIN D-20 — Dual-Clone dust separators — noted for their low resistance and high cleaning efficiency. Easy to install, no maintenance, no moving parts.

BULLETIN 1-585 — Industrial Fans. Complete with helpful selection charts, capacity tables, dimensions and special types and arrangements included.

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BULLETIN N-578 — Gives complete information about Style "A" rotary valves. Construction features, specifications, dimensions and applications.

"SCHLITZ DEFEATS DUST" —
FOOD ENGINEERING magazine reprint describes all out dust control for 3½ million bushel Schlitz grain elevator. Request Bulletin "Schlitz" Defeats Dust"

"EFFICIENT DUST SNATCH-ERS" — Bulletin describes DAY's part in providing maximum safety and good housekeeping for starch packing building of large food processor.

essor.

BULLETIN 510—DAY Unit Dust
Collectors. Complete, low cost
unit designed for plants or applications where central dust
control systems are not practical.

BULLETIN 576 — "HV" heavy duty dust separator. Rugged construction and lower initial cost than many light gauge galvanized type cyclones.

The DAY Company 856 Third Avenue N.E. The DAY Company of Canada Ltd. 15 Brydon Drive, Rexdale (Toronto), Ont. Minneapolis 13, Minnesota Please send Bulletins checked below: "Efficient Dust Snatchers" Bulletin G-30 ☐ Bulletin F-75 ☐ Bulletin N-578 **Bulletin D-20 Bulletin 510** ☐ "Schlitz Defeats Dust" ☐ Bulletin 576 ☐ Bulletin I-585 Name_ Company Name_ Address

Convention Calendar

April

25. American Association of Cost Engineers, Metropolitan N. Y. Section, 4th Annual Meeting, Hotel Manhattan, New York, N. Y.

23-26. American Society of Mechanical Engineers, Metals Engineering Conference, Penn Sheraton Hotel, Pittsburgh, Pa.

26-27. American Institute of Mining, Metallurgical and Petroleum Engineers, High Temperature Materials Conference, Pick-Carter Hotel, Cleveland, Ohio.

26-28. American Rocket Society, Propellants, Combustion and Liquid Rockets Meeting, Palm Beach Biltmore Hotel, Palm Beach, Fla.

30-4. Electrochemical Society, Spring Meeting, Claypool Hotel, Indianapolis, Ind.

May

1-3. American Oil Chemists' Society, 52nd Annual Meeting, Sheraton-Jefferson Hotel, St. Louis, Mo.

1-5. American Society of Training Directors, Inc., 17th Annual Conference, Bellevue-Stratford Hotel, Phildelphia, Pa.

2-4. Purdue University, 16th Purdue Industrial Waste Conference, Purdue Memorial Center, LaFayette, Ind.

3-13. 5th Annual United States World Trade Fair, New York Coliseum, New York, N. Y.

4-5. American Institute of Mining, Metallurgical and Petroleum Engineers, Oil Recovery Conference, Midland, Tex.

7-10. American Institute of Chemical Engineers and the Chemical Engineering Div., Chemical Institute of Canada, Joint Meeting, Sheraton-Cleveland Hotel, Cleveland, Ohio.

8-9. American Society of Mechanical Engineers, Lubrication Symposium, Deauville Hotel, Miami Beach, Fla.

8-9. Society of the Plastics Industry, 19th Annual Canadian Section Conference, Sheraton-Brock Hotel, Niagara Falls, Ont., Can.

8-10. Instrument Society of America, National Power Instrumentation Symposium, LaSalle Hotel, Chicago, Ill.

8-10. Technical Assn. of the Pulp and Paper Industry, 12th Annual Coating Conference, Statler Hotel, Buffalo, N. V.

8-11. American Petroleum Institute, Refining Div., 26th Midyear Meeting, Rice Hotel, Houston, Tex. 8-18. Mechanical Handling Exposition, Earls Court, London, England.

9-11. National Joint Computer Committee, 1961 Computer Conference and Exhibit, Ambassador Hotel, Los Angeles, Calif.

9-11. The Material Handling Institute, Eastern States Show, Trade and Convention Center, Philadelphia, Pa.

9-11. U.S. Army Signal Research and Development Laboratory, 15th Annual Power Sources Conference, Fort Monmouth and Shelbourne Hotel, Atlantic City, N. J.

10-12. American Institute of Chemists, Annual Meeting, Hotel Statler, Washington, D. C.

10-12. Society for Experimental Stress Analysis, Meeting, Benjamin Franklin Hotel, Philadelphia, Pa.

10-12. American Society of Mechanical Engineers, Production Engineering Conference, Royal York Hotel, Toronto, Ont., Can.

10-12. Instrument Society of America and Technical Assn. of the Pulp and Paper Industry, Symposium on Pulp and Paper Instrumentation, Northland Hotel, Green Bay, Wisc.

11-13. American Institute of Industrial Engineers, 12th Annual National Conference and Convention, Sheraton Cadillac Hotel, Detroit, Mich.

15-19. National Fire Protection Assn., Annual Meeting, Statler Hotel, Detroit, Mich.

21-23. Fluid Controls Institute, Spring Meeting, The Cloister, Sea Island, Ga.

22-24. American Society for Quality Control, Annual Convention and Exhibition, Sheraton Hotel, Philadelphia, Pa.

22-25. American Society of Mechanical Engineers, Design Engineering Show, Cobo Hall, Detroit, Mich.

22-26. American Society of Tool and Manufacturing Engineers, 1961 Engineering Conference and Tool Show, New York Coliseum, New York, N. Y.

23-25. Office of Naval Research, Information Systems Branch, Symposium on Large Capacity Memory Techniques for Computing Systems, Dept. of the Interior, Washington, D. C.

Later

June 21-23. American Assn. of Cost Engineers, Annual Meeting, Somerset Hotel, Boston, Mass.

November 27-December 1. 28th Exposition of the Chemical Industries, New York Coliseum, New York, N. Y.

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Accuracy, flexibility, inherent safety, simplicity and ease of servicing ... add these together and you have Robertshaw's all-pneumatic controls for industry.

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Controls 3 to 15# air signal to valve, damper actuator or other device to provide positive control of temperature or pressure. Knob adjustment, modulating action, adjustable proportional band, field reversible.



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Used as controller, transmitter, receivercontroller. Proportional action, 0.5 to 200%. Fully compensated thermal system; automatic reset optional. Easily installed and serviced.



Control Valve

Available with diaphragm or bellows actuators for exact, constant control of more fluids of all types.



Float-Type **Level Control**

Air-actuated control for valves. etc, on boilers, process vessels and open or pressurized systems. Utilizes permanent ceramic magnets for activating on-off pneumatic "switch."



FultroMatic Control System

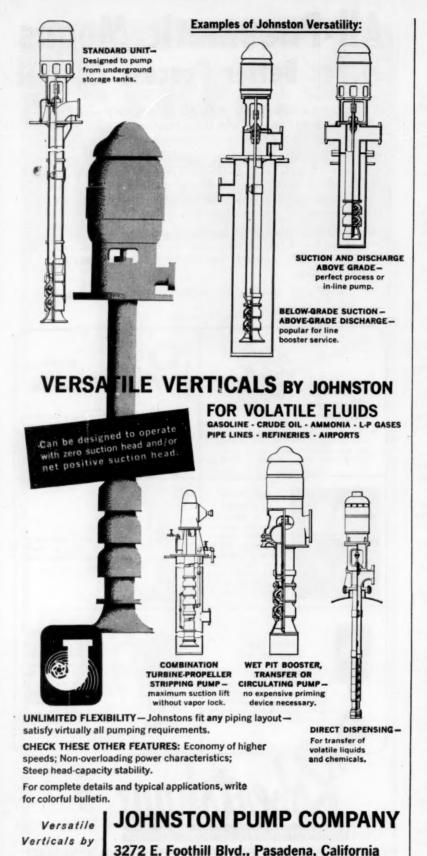
A 3-in-1 unit (controller, positioner, valve) for precise temperature or pressure at about ½ the cost of 2- and 3-unit systems. Improved accuracy. faster response, positive positioning, ad-justable proportional



Robertshaw-Fulton Controls Company



FULTON SYLPHON DIVISION, KNOXVILLE 1, TENNESSEE



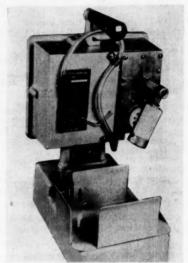
NEW EQUIPMENT . . .

(Continued from page 148)

tained and the valve turns quickly and easily.

Interchangeable seats are available in buna-N, neoprene and Teflon. Maximum rating is 1,000 psi. for a \(\frac{3}{4}\)-in. valve using Teflon seats; for smaller pipe and other seats, rating drops as low as 300 psi. Valve comes in eight sizes from \(\frac{4}{4}\)-2 in., all available in stainless steel, carbon steel or brass.

—Clayton Mark & Co., Evanston, Ill.



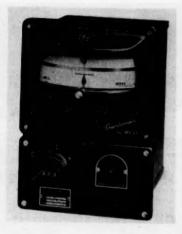
Effluent sampler Portable unit continuously takes samples of flammable liquids.

To protect against explosion, this compact $(8 \times 12 \times 15 \text{ in.})$ and lightweight (15 lb.) effluent sampler encapsulates its motor, battery and associated electrical components in a cast-aluminum housing that meets Class L, Group D specifications for explosion proof equipment.

Sampler operates continuously for periods up to 1,000 hr. on one lantern battery. Oscillating cylinder pump, which collects samples at the rate of 1 gal./day, is made of linear polyethylene throughout for corrosion-resistance to organic solvents or caustics.

Water seal maintains a pressure

of 4 in. H₂O on the collected sample, thus preventing loss of volatile petroleum fractions and dissolved gases.—Brailsford & Co., Inc., Rye, N. Y. 222A



Set-point controller

Temperature or other mv. sources are accurately controlled with unit.

Adjusting the three-digit, 1,000-part dial of a new set-point controller gives control point increments as small as ½-deg. A null balance circuit provides greater sensitivity, giving control to better than 0.25 deg. with most thermocouples.

Model JY series may be calibrated for temperature or millivolt applications in single, dual or triple range models. Leadwire length does not affect calibration; continuous electric cold-junction compensation is provided. Available in on-off, proportioning and stepless control modes, unit operates with solid-state controllers.—West Instrument Corp., Chicago. 223A

Temperature controller Plug-in device anticipates actual setpoint, triggers corrective relay.

For maintaining constant temperature in oil and water baths, ovens, packaging machinery and the like, this device is designed to eliminate sawtooth fluctuations across the setpoint by triggering a relay just before fluid arrives at



Swenson's new Draft Tube Baffle Crystallizer is the most advanced equipment yet designed for production of large, uniform crystals required in fertilizers and similar materials. Low first cost and long operating cycles, plus unusually simple control of operation, offer high product quality at significant production economies.

Bulletin SW-206, Draft Tube Baffle Crystallizers, describes operation in full detail. Write for it today: Swenson Evaporator Company, 15669 Lathrop Ave., Harvey, Illinois. In Canada: Whiting Corporation (Canada) Ltd., 350 Alexander Street, Welland, Ontario, Canada.



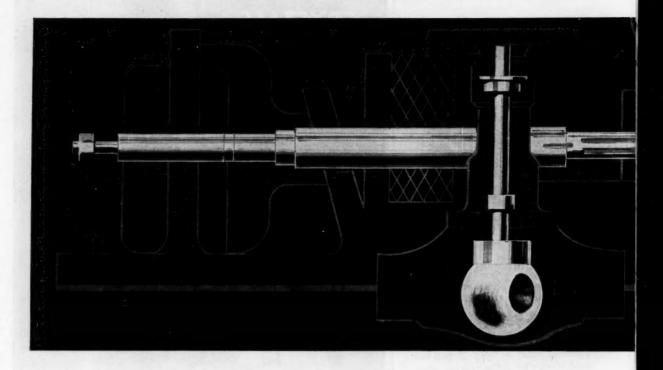
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How to Cut Controllable Costs with Armco 17-4 PH Stainless Steel



By using Armco 17-4 PH Stainless Steel for equipment parts such as pump shafts, valve stems and trim, bolts, and mixer screws, many processing plants have cut maintenance costs, expensive downtime, and first costs as well.

You, too, can gain these savings because this special precipitation-hardening Armco Stainless Steel has a **unique** combination of properties—

- Excellent corrosion resistance, comparable to Type 304 in most media. Superior to the regular hardenable stainless grades.
- Up to 200,000 psi typical tensile strength, 180,000 psi typical yield in Cond. H 900.
- · Hardness up to Rockwell C-44.
- · Hardened by a simple low temperature heat

treatment, only 1 hour at 900 to 1150 F.

 Mechanical properties can be balanced to your needs by varying the hardening temperature.
 For critical parts of processing equipment that must resist corrosion as well as wear and abrasion, high stresses, cavitation, or temperatures to about 600 F, Armco 17-4 PH Stainless Steel offers you opportunities to make substantial cost reductions. Its performance in chemical and allied processing has made it one of the most widely used stainless steels.

Write us today for more specific information on how and why Armco 17-4 PH Stainless Steel can help you cut costs. Armco Division, Armco Steel Corporation, 1791 Curtis Street, Middle-

town, Ohio.



Armco Division

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(A) Sheets, Strip and Plates (B) Bars and Wire

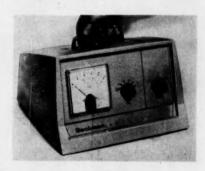
AMERICAN STEEL & ALUMINUM CORP. Hartford, Conn.	(Al
AMERICAN STEEL & ALUMINUM CORP. OF MASS. Cambridge, Mass.	(A
BROWN-WALES COMPANY Cambridge, Mass.—Auburn, Maine— Worcester, Mass.	(Al
CENTRAL STEEL & WIRE COMPANY Chicago, III.—Cincinnati—Detroit—Milwaukee	(Al
CHICAGO STEEL SERVICE COMPANY Chicago, III.	(AE
CLEVELAND TOOL & SUPPLY COMPANY Cleveland, Ohio	(8
THE CONGDON AND CARPENTER COMPANY Providence, R. I.—Fall River, Mass.	(AE
C. A. CROSTA, INC. Denver, Colo.	(#
DUCOMMUN METALS & SUPPLY COMPANY Los Angeles, Calif.—Berkeley—Phoenix— San Diego—Seattle	(AE
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GATE CITY STEEL, INC.—OMAHA Omaha, Nebr.	(A
INDUSTRIAL STAINLESS STEELS, INC. Cambridge, Mass.—Buffalo, N. Y.	(B
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MAPES & SPROWL STEEL COMPANY Union, N. J.	(AB
METAL GOODS CORPORATION St. Louis, Mo.—Dallas—Denver—Houston— Memphis—New Orleans—N. Kansas City, Mo.—Tulsa—Wichita	(AB
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MORRISON STEEL COMPANY New Brunswick, N. J.	(AB)
THE ORLEANS STEEL PRODUCTS COMPANY, INC. New Orleans, La.	(A)
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PAPER-CALMENSON & COMPANY St. Paul, Minn.	(A)
RICHARDS & CONOVER STEEL & SUPPLY COMPANY Kansas City, Mo.	(A)
SEABOARD STEEL & IRON CORP. Baltimore, Md.	(B)
SENECA STEEL SERVICE, INC. Buffalo, N. Y.	(AB)
SOUTHER STEEL & ALUMINUM COMPANY St. Louis, Mo.	(A)
J. M. TULL METAL & SUPPLY COMPANY, INC. Atlanta, Ga.—Birmingham—Greenville, S. C.— Jacksonville—Miami—Tampa	(AB)
VIKING STEEL COMPANY Cleveland, Ohio	(AB)
VORYS BROTHERS, INC. Columbus, Ohio	(AB)
YORK CORRUGATING COMPANY York, PaWashington, D. C.	(A)



setpoint temperature, instead of waiting for target to be hit.

Unit's standard operating range is 0-800 F., but another model has resistance-type controls to cover temperatures from -300 to +2.000 F.

Epoxy casing protects mechanism from shock and vibration. Calibrated dial and pilot light are optional. — Electronic Processes Corp., San Francisco. 223B



Moisture meter

Portable monitor detects, records trace quantities of gas moisture.

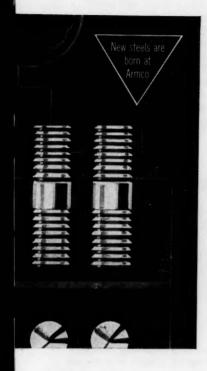
Described as accurate to ±5% of full scale, "hydromite" continuously monitors water vapor in ppm. ranges of 0-10, 0-30, 0-100, 0-300 and 0-1,000. Rapid detection of ppm. changes makes it applicable to chromatographic techniques.

Optional electrolytic cell removes and electrolyzes water from samples containing hydrogen concentrations exceeding 50%. Encased in impact-resistant plastic, the 11-lb. unit can be operated either with a.c. power or with its own built-in battery. — Beckman Scientific and Process Instruments Div., Fullerton, Calif. 225A

Densitometer

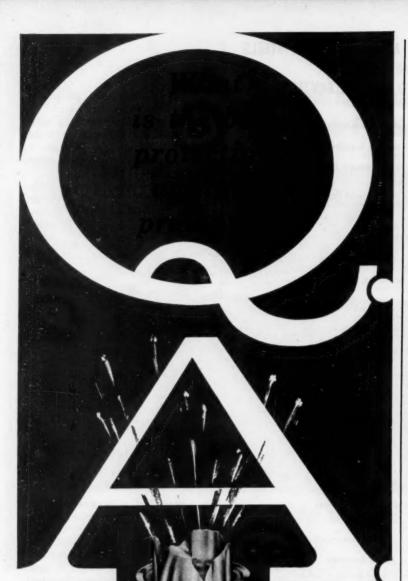
Flowing liquids are continuously weighted in pneumatic device.

Specific gravity of flowing fluids such as drilling muds, additives and black liquor can be determined and recorded continuously by this





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A BS&B Safety Head!

If you have a vessel or process system under pressure, you need a BS&B Safety Head. The Safety Head contains a thin metal disc which will rupture at a predetermined pressure to give complete and instantaneous protection.

Rupture discs are available in pressure ratings from 5 to 100,000 psi., in standard sizes from ¼ to 49-inch diameter. Disc materials include aluminum, copper, stainless, Inconel, Monel, nickel, silver and platinum. These discs are also available with non-porous linings, lead, Kel-F, Teflon, Plastic and spray coatings.

Let us show you how a BS&B Safety Head will protect your process. Write: Black, Sivalls & Bryson, Inc., Dept. 2N-4 7500 East 12th Street, Kansas City 26, Missouri.





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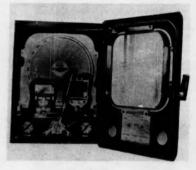
KANSAS CITY . EDMONTON . LONDON . PARIS . THE HAGUE

NEW EQUIPMENT . . .

portable instrument. Indications are independent of flow rate, temperature or pressure.

Accuracy within ±1% is promised for readings taken under as much as 150 psi. and 300 F. Actuating air requirement is 0.1 scfm.; air supply pressure, 15 to 400 psi.

Self-contained device is made of stainless steel and aluminum. except for the low-pressure bellows, which are neoprene. Dimensions: $10 \times 34 \times 15$ in.—Bell Corp., Odessa, Tex. 225B



Recorder Pneumatic recording controller is rugged, simple to maintain.

Features reported for this pneumatic recorder are good frequency response (essentially flat to over 300 cpm.), low air consumption (less than 0.1 scfm. at 1-psi. drop), high tolerance to shock, and high temperature stability.

Available with four modes of control, the unit can be used in conjunction with measuring elements for control of pressure, temperature, flow, humidity or differential liquid level. Proportional controller is adjustable (even in low proportional band region) from 0-400% by flicking a dial. A proportional-plus-reset model is adjustable from 0.1 to 100 repeats/min., with the same 0-400% proportional band range.

Measuring 14\(^3\) \times 10\(^3\) in., instrument is cased in die-cast aluminum. Working parts are stainless steel; diaphragms, neoprene. Records are traced on standard 8-in. charts.—The Bristol Co., Waterbury, Conn.



DOW RECOVERS 425°F WITH LJUNGSTROM® AIR PREHEATER

When Dow Chemical Company's Westside Power House at Midland, Mich., starts up their new 650,000 lb/hr boiler, more than half the waste heat will be recovered by a Ljungstrom Air Preheater. Dow's newest Ljungstrom (this is the eighth in their system) was designed to lower stack gas temperature from 700°F to 275°F, thus recovering 425°F. As a direct result,

company engineers expect at least 10% reduction in fuel costs.

On process stills or boilers—or wherever large volumes of heat are involved—Ljungstrom Air Preheaters improve combustion, make fuel burn more completely. It's possible to save as much as 20% on fuel.

All major public utilities use Ljungstroms; as do many major chemical and petroleum processing

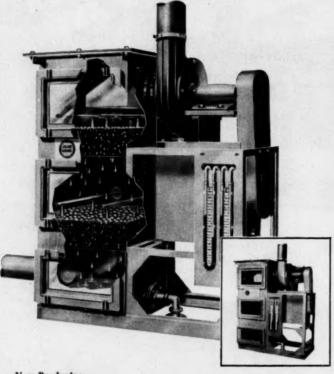
This 25' Ljungstrom rotor will contain a total heating surface of 128,000 sq ft. Continuous heat recovery by this unit will boost the temperature of incoming combustion air from 100°F to 585°F. Every 45-50°F thus returned as preheat increases boiler efficiency about 1%.

companies. Chances are, you, too, could benefit. For additional information, call or write The Air Preheater Corporation, specifying type of application.

THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N.Y.

New Ideas On Dust And Fume Control



New Products:

John Wood Interphase Flooded-Bed Scrubber

This unique approach to the removal of fumes, vapors and dust from ventilation systems offers a new high in operating efficiency. In fact, efficiencies in adsorption and absorption of NO_2 exceeding $95\,\%$ and of HCl of virtually $100\,\%$ have been obtained.

Two horizontal beds operating under flooded conditions break the air stream into bubbles 1/16 inch in diameter. Completely surrounded by the scrubbing liquid and subject to impaction forces caused by continuous change of direction, the bubbles break up. Rapid absorption is the result.

The John Wood Flooded-Bed Scrubber is a compact, integrated unit. Construction is corrosion proof and provides easy access for servicing.

New Engineering: The complete line of John Wood equipment also includes Venturi Scrubbers, Multi Cyclones, Involute Cyclones, Fabric Filters and combination units. Extensive John Wood laboratories are available for advanced research on your air pollution problems.

New Service: John Wood Air Pollution Control is fully programmed from analysis of existing conditions to equipment installation. Frequently economies result that make the installation self-liquidating through lower maintenance and replacement costs.

Write for engineering assistance or specific product information. An air pollution preliminary analysis kit is available without obligation.



NEW EQUIPMENT . . .



Solids transporter Portable pneumatic carrier takes plastic pellets from pot to pot.

All-aluminum, the lightweight "airveyor" features a positivepressure, constant-displacement air blower that sucks up pelletized or granulated plastics in one location, wheels the cargo to another location for regurgitation.

Vacuum (intake) side of the unit is split from the pressure (discharge) side by a cyclone receiver, which whirls the incoming material out of its conveying stream. Solids are reintroduced to discharge air stream through a high-efficiency rotary airlock. Second-stage separator contains filter media to prevent blower damage from material carry-over.

Airveyor comes in three models, identified by 2, 3 or 4-in.-dia. conveyor lines. All models have a filter-cartridge scavenger tank to trap objectionable pellet floss and fines. Capacity ranges from 4-20 ton/hr. for pellets approximately in round.

Total power ratings for the three models are 20, 37 and 66 bhp. respectively.—Fuller Co., Catasauqua, Pa. 228A

Ball valves

Bronze, steel and stainless steel units take pressure to 800 psi.

Two-directional, with low operating torque, these valves range in size from ½ to 2 in. Teflon seats and chrome-plated balls maintain bottle-tight shutoff, even in air and volatile-fluid service.

Unique design feature is tapered



HOW TO RUN TWO SIMPLE TESTS ON PROCESS PIPE CORROSION

Test One

Take material samples of any corrosion-resisting pipe. Place them in beakers containing any acids, series of acids or combination of acids. Boil them, cool them or store them for any length of time you feel necessary.

Then compare the corrosion of the materials tested.

Next—look at the beakers you used! The chances are very good they are PYREX® brand beakers. And if they are, it should be evident that the beakers stand your test better than the materials tested.

You can have this same high corrosion resistance when you use Pyrex[®] brand process pipe.

Test Two

The second test is more practical. Place one length of PYREX pipe in one of your most demanding process lines. It connects easily to other lines. Then compare it in actual use with the

pipe you are using.

PYREX pipe is transparent. You can see through the pipe wall into the flow area. If you do have trouble with your process, you can locate it at a glance. No hit-or-miss dismantling. You nip minor problems before they become major. Hardly any maintenance or replacement costs to pick your pockets, either.

You can also get Pyrex "double-tough" drainline for applications where you're handling corrosive wastes. Same tough glass. Same advantages.

PYREX pipe comes in all standard sizes and fittings. Want more specifics? Write for PYREX Pipe Bulletin, PE-3.



CORNING GLASS WORKS

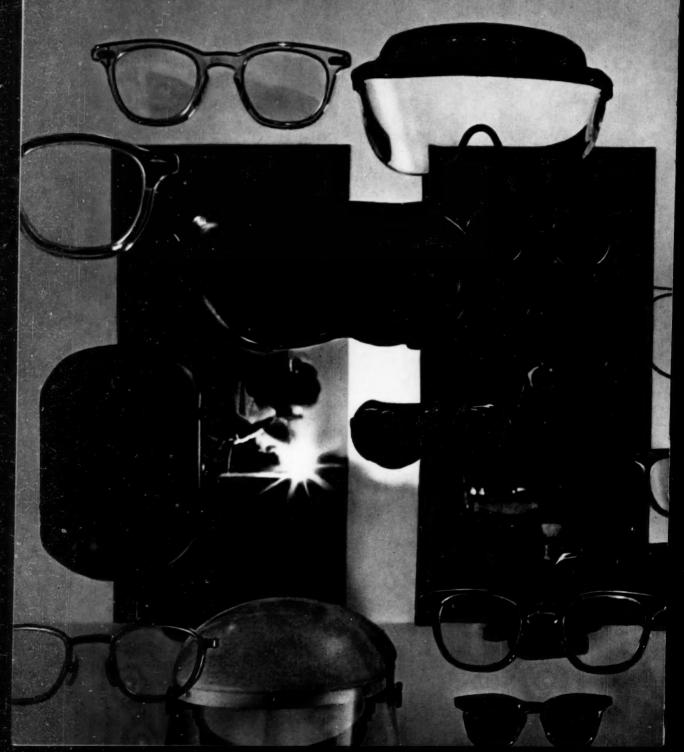
8904 Crystal Street, Corning, New York

CORNING MEANS RESEARCH IN GLASS

CHEMICAL ENGINEERING—April 17, 1961

THE LOGIC OF PLACING YOUR SAFETY EYEWEAR BUSINESS WITH THE MAN FROM MSA: enough styles, enough optional features to satisfy the whim of any wearer. We'd like to help you win your worker's full-time exceptance of eye and face protection. It shows through in the sheer weight of numbers we offer the wearer to choose from. You see it again in the smart, trim lines of the styling. It's visible too in our ability to match the right equipment to the right job. Add to this big picture approach a complete vision program, including Rx service. And there you have it. A truly complete package. That's why it's so logical to place your safety eyewear business with the Man from MSA.

MINE SAFETY APPLIANCES COMPANY, Pittsburgh 8, Pennsylvania







Ready for shipment, this FEinc Horizontal Filter was custom designed for solvent processing service. The unit is an 8' diameter, totally enclosed, pressure horizontal filter featuring the unique center shaft design.

Why settle for less than a **FEINC** CUSTOM DESIGNED Horizontal Filter?

FEinc Horizontal Filters custom designed for *any* continuous separation of free-filtering or free-settling materials, such as coarse crystalline materials or fibrous pulps, offer:

- Extremely high hourly output.
- Multiple-stage or counterwashing for maximum recovery . . . minimum dilution.
- Visible results . . . easy control.
- Cakes built up to 4" or more.
- No separate foundations
 . . . can be skid mounted.
- Totaliy enclosed, rubber covered or other special construction.
- Sizes from 7.6 to 170 sq. ft.

FEinc matches the filter, its size, construction materials and special features necessary for highest efficiency to Your specific filtration problem . . . often at no more than standard filter cost.

INVESTIGATE BEFORE YOU DECIDE. If you have any filtration problem . . . contact us. Compare our recommendations and quotations on vacuum or pressure rotary drum — scraper, string or roller discharge — horizontal table or precoat filters. We offer both complimentary laboratory test and pilot plant rental services. See our section in Chemical Engineering Catalog or write Dept. CEF-461.



This 12' FEinc Horizontal Filter has the conventional roller-tooth gear drive with spur gear engaging roller chain on rotating unit. The ball type main bearing has a replaceable hardened race. Sizes up to 18' in diameter.



A 3' FEinc Horizontal Filter offers 7.6 sq. ft. of filter area or about twice as much as most competitive designs. More filter area is available because of the

unique center shaft construction. This unit is available for pilot trial in your plant.

For a FEINC®

FILTRATION ENGINEERS

CUSTOM DESIGNED CONTINUOUS FILTRATION



STRING



HORIZONTAL



SCRAPER

Divisions of American Machine and Metals, Inc.

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Wolverine Prime Surface Tube



Wolverine Trufin Type S/T



Wolverine Prime Surface Tube (Duplex)



Wolverine Trufin Type S/T (Duplex)



Wolverine Trufin Type I/L



Wolverine Trufin Type H/R

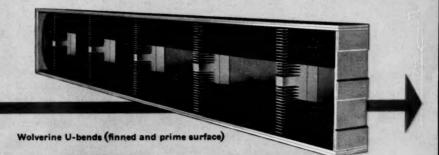


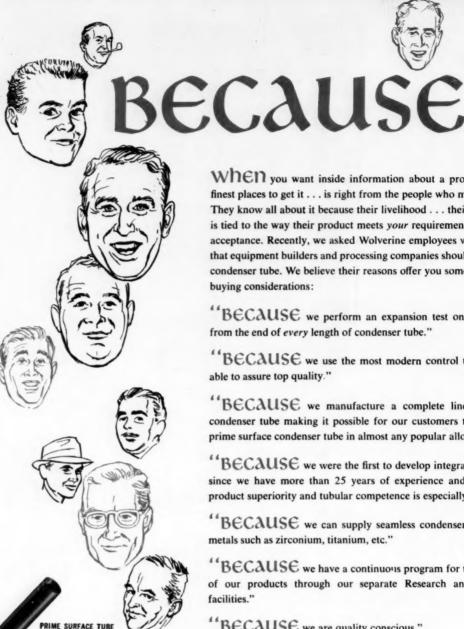
Wolverine Trufin Type H/A



Wolverine Trufin Type L/C (Bimetal)

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cartridge containing entire seating assembly, which can be removed easily while valve body remains in the line. Interchangeable parts make for simpler maintenance. No shims or springs are incorporated.

Valve handles need only a quarter of a turn from full open to full closed. Bright orange plastic sheaths advertise valve position to operator.—Crane Co., New York.

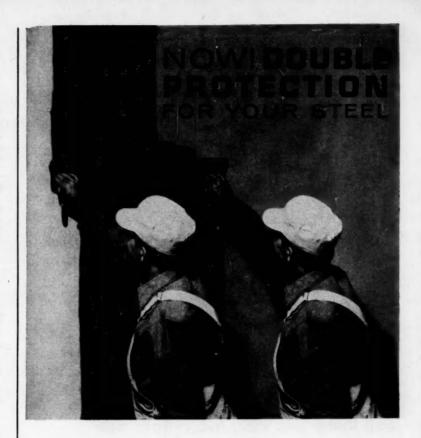
Briefs

Template for isometric drawing, patented and enterprisingly distributed by a graduate engineer, helps beginners make professional pipe-layout sketches. Laminated of clear plastic, the pocket-size drafting aid has cutouts for most common fitting symbols, rounded corners for uniform angles, handy compass orientation points. It sells for \$2.50.—Wally Verrett, Port Arthur, Tex.

Bucket elevator is do-it-yourself model that can be assembled at point of use by one man. Lightweight unit includes bottom section with built-in slide gate, head section with discharge chute, also belt or chain and buckets and drive components (motor optional), and necessary hardware. With up to 4 cfm. capacity, elevator discharges 6 to 8 ft. above floor level, can add midsections for higher deliveries. — Bucket Elevator Co., Chatham, N. J. 235B

Bronze ball valve seals positively in either direction. A spring, retainer and O-ring seal, behind the valve seat, are said to insure constant compression, self-adjustment and a tight seal even on low pressure, vacuum lines.—H. M. Cutler & Co., Worcester, Mass. 235C

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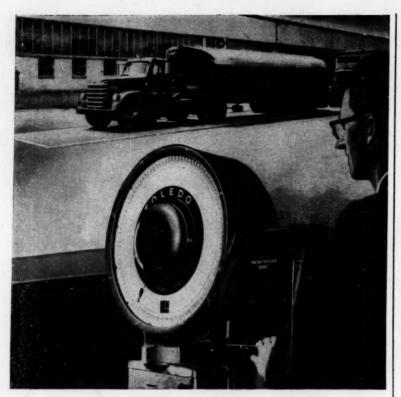
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use at much lower pressure.— Autoclave Engineers, Inc., Erie, Pa. 235D

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—Allegheny Plastics, Inc., Coraopolis, Pa. 236B

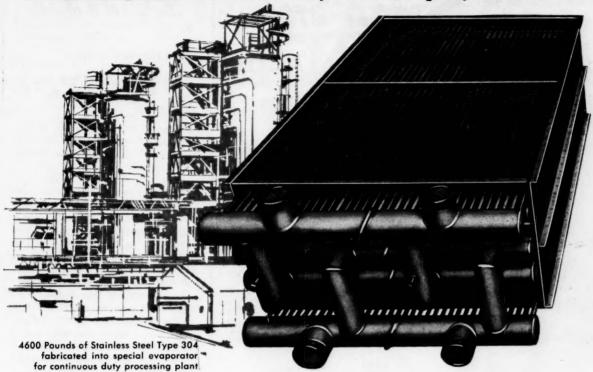
Steam trap achieves high efficiency by placement of baffle in a position that deflects incoming steam around the bellows. Result: fast closing action to prevent livesteam loss.—W. H. Nicholson & Co., Wilkes-Barre, Pa. 236C

Equipment Cost Indexes .

-4		
	Sept.	Dec.
	1960	1960
Industry		
Avg. of all	237.4	237.3
Process Industries		
Cement mfg	231.7	231.6
Chemical	238.6	238.1
Clay products	225.6	225.1
Glass mfg	225.3	224.8
Paint mfg	229.1	229.4
Paper mfg	229.9	229.4
Petroleum ind	234.0	234.3
Rubber ind	237.9	237.1
Process ind. avg	236.2	236.1
Related Industries		
Elec. Power equip	240.2	238.3
Mining, milling	240.0	239.5
Refrigerating	267.7	268.0
Steam power	224.3	224.5

Compiled quarterly by Marshall and Stevens, Inc. of Ill., Chicago, for 47 different industries. See Chem. Eng., Nov. 1947, pp. 124-6 for method of obtaining index numbers, March 6, 1961, pp. 115-116 for annual averages since 1913.

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RUSSIAN FOR SCIENTISTS. BY C. R. BUXTON AND H. S. JACKSON, INTER-SCIENCE, 299 PAGES, \$5.25.

These two Interscience books have the same purpose and essentially the same content, but differ vastly in organization and presentation. Both aim to give the scientist an adequate reading knowledge of technical Russian; both include a comprehensive outline of grammar plus numerous translation exercises. But there the similarity ends.

Perry's book is subtitled "A Text-book for Classes and Self-Study." It is, in fact, an excellent text. Introductory lessons ease the student into familiarity with the Russian (or Cyrillic) alphabet by illustrating words that are similar to their English counterparts, and provide basic discussion of purely Slavic words. The chapters following cover various aspects of grammar and build up the student's vocabulary.

Each lesson is a well-presented, self-contained unit. Grammatical concepts are clearly explained and generously illustrated, and the discussion is followed by exercises. As is to be expected, a student would use this book by proceeding from lesson to lesson, and the presentation is more likely to nourish his interest than reduce it.

One unexpected flaw is found in the lesson sequence: Perry defers his discussion of numerals—admittedly a difficult concept in Russian, but a basic one for any language until near the end of the volume.

Buxton's book also aptly fits its subtitle: "A Grammar and Reader." The first third of it is a terse, comprehensive summary of grammar—with no interspacing of exercises or reading material except for an initial alphabet-familiarization section. The grammar is followed by reading sections that contain indi-

vidual phrases and sentences, and then longer passages.

Even the early portions of the phrases-and-sentences section incorporate some fairly advanced grammatical concepts. Thus, the student is expected to digest quite a bit of raw grammar before trying to apply any of it through exercises. And there is no direct page-reference correlation between grammar and reading.

Contents of this book might better have been placed in two separate volumes—a reference syllabus of grammar, and a technical reader to supplement a well-organized textbook such as Perry's.

Having noted the great difference in organization, it is harder to favor one book over the other because of content. Both show up well after a spot-check for coverage of various grammatical points, with Perry deserving perhaps a slight edge. Perry also seems to present a greater number of nontechnical words, which the scientific reader will often encounter (or may wish to know in any event).

On the other hand, Buxton's book has an air of broad scholarliness about it that will appeal to a mature, well-rounded student. The author includes comments of historical or purely linguistic interest, and points out comparisons with other languages in the Indo-European group.

A weakness common to both books is that they present new words faster than the student may be able to absorb them.

In summary, each of these works provides a good, comprehensive package of Russian. But for specific textbook use, Perry's is easily worth the extra \$4.25.—NPC.

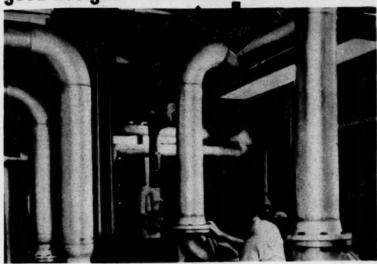
PRINCIPLES OF HYDROGEN MANUFACTURE (OSNOVY PROIZVODSTVA VODORODA). By V. B. JOFFE. GOSTOPTEKHIZDAT, LENINGRAD. 430 PAGES. 15 RUBLES (APPROXIMATELY \$2.25).

Reviewed by S. M. Walas, U. of Kansas, Lawrence, Kan.

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manufacture and the upgrading of low-quality liquid and solid fuels.

Joffe's book is a moderately detailed summary of the properties, manufacture, purification and handling of this substance on an industrial scale. The author, associated with the State Institute for the Nitrogen Industry (USSR), has based his work partly on studies made there and partly on published information.

Most of the common methods currently employed and some others of limited or perhaps historical interest are described: iron-steam reaction, water gas from solid fuels, carbon monoxide-steam reaction, carbon dioxide-steam reaction, conversion of liquid and gaseous hydrocarbons by catalytic and thermal means, and also electrochemical methods.

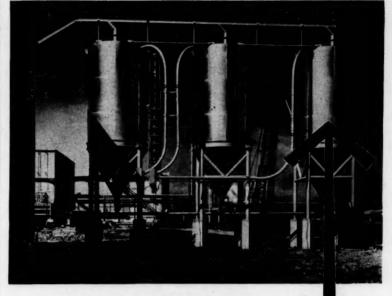
A chapter is devoted to methods suitable for mobile and small-scale units. Storage and safety measures are considered in two brief chapters. Roughly one fourth of the text is devoted to separation and purification techniques. About 90 tables and a like number of figures present physical and operating data, flowsheets, photographs and schematics of equipment. The scientific basis of each process is especially well treated for an industrial book. Data on consumption of raw materials and utilities are frequently given. (No costs are cited but in any event these would have little meaning to the engineer in the USA.)

Documentation is rather sketchy with only 126 references to the literature, of which one-third are to Soviet sources. For example, flow-sheets are shown for a number of plants in the USA, Italy, France and Germany that are described in other literature and often in greater detail, but Joffe does not supply these references.

All in all, this is a well rounded, well organized, respectably printed survey of industrial hydrogen. As with all Soviet books, the price is extremely modest. Engineers not overly familiar with the Russian language may still derive much benefit from the book by reading figure titles and table entries with

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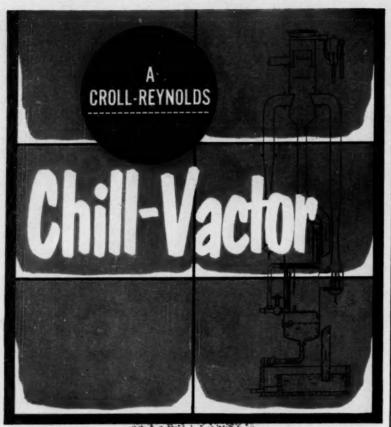
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[In addition to OTS's work cited above, the agency publishes its own translations of significant Soviet literature. Among its recent crop are the following—all of which are available from Office of Technical Services, Business and Defense Services Administration, U.S. Dept. of Commerce, Wash. 25, D. C.]

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English Abstracts of Selected Articles from Soviet Bloc and Mainland China Technical Journals.

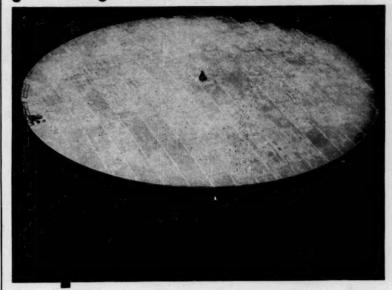
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Mathematical Handbook for Scientists and Engineers. By G. A. and T. M. Korn. McGraw-Hill. 943 pages. \$20.

Physical Chemistry. 2nd ed. By F. Daniels and R. A. Alberty. Wiley. 744 pages. \$8.75.

Chemical Processing Nomographs. Ed. by D. S. Davis. Chemical Publishing Co. 255 pages. \$12.

Source Book of the New Plastics. Vol. 2. By H. R. Simonds. Reinhold. 310 pages. \$8.95.

A Short History of Technology. By T. K. Derry and T. I. Williams. Oxford. 782 pages. \$8.50.

Applied Thermodynamics. By S. H. Bransom. Van Nostrand. 230 pages. \$6.

A History of Science, Technology & Philosophy in the 18th Century. 2 vols. By A. Wolf. Harper Torchbooks (paperback, reprints). Heavily illustrated. Vol. I: pages 1-409, \$2.50. Vol. 2: pages 410-814, \$2.50.

The Nature of Thermodynamics. By P. W. Bridgman. Harper Torchbooks. 239 pages. \$1.40.

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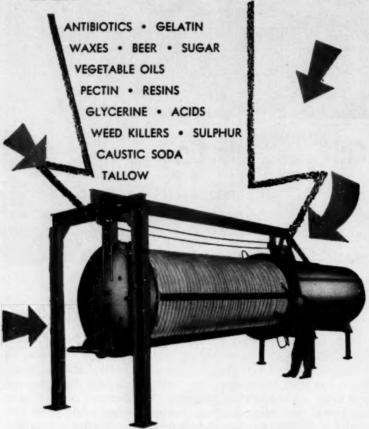
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Letters: Pro & Con

Pro: Constructive Review

Sir:

Your review of the McGraw-Hill "Encyclopedia of Science and Technology" (Feb. 6, pp. 144-153) is by far the most constructive that we've had to date. We appreciate the time and trouble that you've spent on this and want to thank you for a most helpful evaluation. Our staff editors are busily checking their own areas, and I can assure you that the next edition will show the signs of your very helpful comments.

CARL E. NAGEL

McGraw-Hill Book Co. New York, N. Y.

Watch Your Multiplication

Sim .

I take exception to Mr. Caras' method of checking multiplication as shown on p. 172 of your Feb. 20 issue.

In the example shown, or in any such multiplication, if the product contains the same digits as the correct answer but the digits are in the wrong order, the multiplication will still prove "correct" by Mr. Caras' method. Further, an entirely different set of digits would also "prove" if the sum of them happens to give the right number.

J. H. BOYDEN. JR.

W. R. Grace & Co. New York, N. Y.

Supplied: Polycarbonate Data

Sir:

In your Jan. 23 issue (p. 190) Mr. D. E. Miller asked for information on polycarbonates. He, as well as other *CE* readers, might be interested in the variety of recent literature on polycarbonates.

Manufacturers, a market forecast, properties, fabricating techniques and prices have been summarized in several issues of *Chemical Engineering* (Apr. 4, 1960, p. 88; Oct. 17, 1960, p. 108; Nov. 14, 1960, p. 174; Jan. 9, 1961, p. 91).

Processes, properties, test data, advantages and disadvantages, with seven additional references, are available in *Industrial & Engineering Chemistry* [Vol. 51, No. 2, p. 157 (1959)]. Some process information may be found in Golding's book ("Polymers and Resins," p. 289, Van Nostrand, 1959). The Kirk-Othmer "Encyclopedia of Chemical Technology" now includes excellent coverage (2nd supp., p. 587, 14 references, Interscience, 1960).

Modern Plastics contains some detailed information on fabrication techniques and physical properties (Sept. 1959, pp. 137-44, 225; Dec. 1960, pp. 143-6; Jan. 1961, pp. 107, 201; "Modern Plastics Encyclopedia," 1959 ed., pp. 137-8; 1960 ed., pp. 132, 141, 611, 694; 1961 ed., pp. 95-8, properties chart facing p. 600, recent developments p. 283).

A recent review with 11 references presents properties graphically [Brit. Plastics, Vol. 33, 406-9 (1960)].

Patents disclosing new applications for polycarbonates have appeared recently in various countries (U.S. 2,950,266; Brit. 840,750; 839,858; 808,485; 808,486; 808,488; 808,489; Ger. 1,031,512; 1,026,958).

CALEB F. DAVIS, JR. Cornell University Ithaca, N. Y.

Pro: Canadian Educators

Sir:

While reading about the Kirkpatrick Award for Chemical Engineering Achievement (Feb. 20, pp. 84-6), I was struck by the fact that no Canadian chemical engineering educator is on the Committee of Award.

I feel that the chemical engineering prowess in some—if not all—Canadian universities must be at a high level, and that their participation in American organizations is active. I would anticipate that inclusion of at least one eastern Canadian and one western Canadian university chemical engineering head on the Committee of



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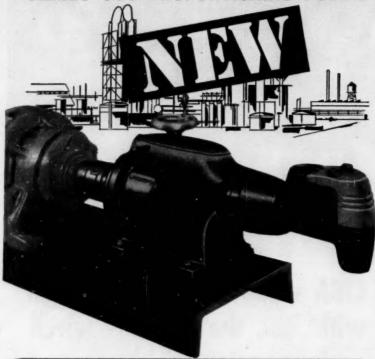
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PRO & CON . . .

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R. E. LESUEUR

Clover Bar, Alberta

▶ The committee is composed of the department heads of chemical engineering schools accredited by Engineers Council for Professional Development. Inasmuch as ECPD does not operate outside the U.S., Canadians are automatically excluded. This in no way reflects, of course, on the quality of chemical engineering education in Canada or any other country outside the U.S.—ED.

Numerical Math Corrections

Sir:

Upon study of your article on "Numerical Mathematics for Chemical Engineers" (Feb. 6, pp. 101-6), I noted several errors.

In Eq. (20), the last term in the brackets should have a numerator of 24 instead of 12. Then in the solution of the example using this equation, this numerator again appears incorrectly, this time as 6. Errors in sign were also made.

JACK W. WHATLEY

Richmond, Va.

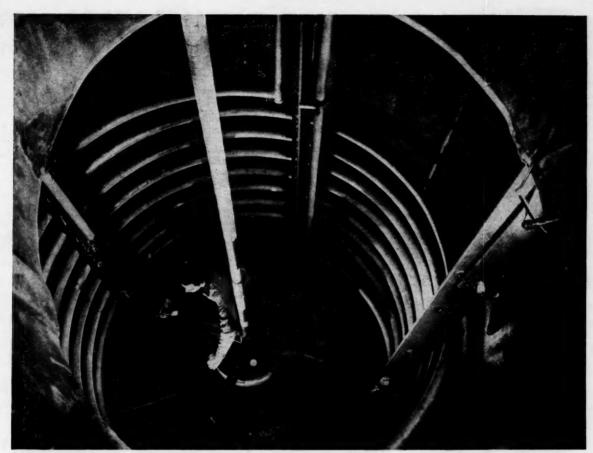
Sir:

Mr. Whatley is correct on all counts. The errors in sign to which he refers involve the final two terms in the bracket of the example following Eq. (20); these should both be minus. The correct answer is thus -0.2116 instead of -0.2111.

Another point of possible confusion is in the nomenclature for this example. To be consistent with the general mathematical formulas, drying rate (the ordinate of Fig. 3) should be expressed as y, and x should $= \theta$, hr. (the abscissa of Fig. 3). Then in the statement of the problem, the term now reading $dx/d\theta = 0.9$ should read $dy/d\theta$ at $\theta = 0.9$.

D. L. WHITLEY

Dow Chemical Co. Freeport, Tex.



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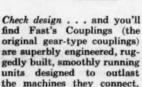
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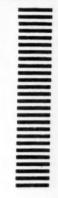
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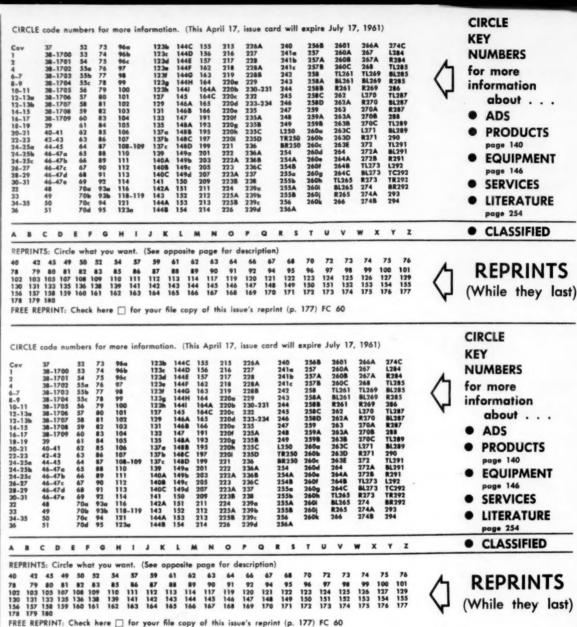
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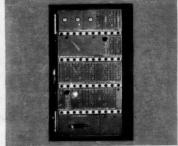
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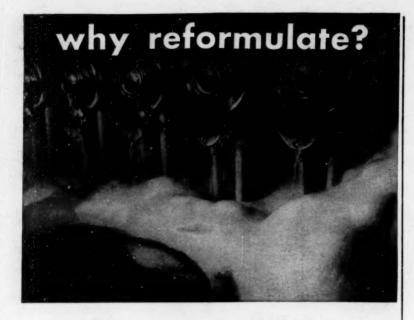


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Career Opportunity for Engineers-Graduate or advanced degrees in EE, Physics, Mathcall or write Gordon Strout, Director-Personnel

ELECTRONIC ASSOCIATES, INC. . Long Branch, New Jersey



A FEW PARTS PER MILLION OF GENERAL ELECTRIC SILICONE ANTI-FOAM KILL FOAM FAST, SAVE YOUR PROCESS

Because so little is required, General Electric Anti-Foam 60 kills foam without affecting the other properties of your process. Thus you avoid the cost of reformulating or redesigning your entire system to end costly foaming.

G-E Anti-Foam 60 disperses instantly in aqueous systems, making it easier to use and faster-acting than other anti-foams. It also comes to you in a higher concentration (30% silicones) for greater convenience in storage and handling.

Many manufacturers have found that G-E Anti-Foam 60 pays for itself by reducing processing time, eliminating costly boil-overs, increasing capacity and improving the quality of their finished product. General Electric Anti-Foams are available for both aqueous and non-aqueous systems.

GENERAL (ELECTRIC

Silicone Products Dept., Waterford, N. Y.

Mail this coupon for free test sample:

Please send me a free sample of	Products Dept., Section GG47, Waterford, H. Y. G-E Anti-Foom
for aqueous systems Application	☐ for non-aqueous systems
Name	Position
Company	
Address	
City	Zone State

LITERATURE . . .

Silicone Release Agents....Publication lists desirable properties of silicone release emulsions, fluids and compounds and provides a guide to aid in their selection. 256A General Electric Co.

Sodium Hydride.....The new 20-page brochure, "Sodium Hydride Dispersed In Oil," a manual covering properties, reactions, handling & safety is available.

199 *Metal Hydrides Inc.

Surfactants....Booklet describes properties and uses of surfactants used by the cosmetic and pharmaceutical industries; includes data on anionic and cationic surfactants.

256B American Alcolac Corp.

Zirconium Crucibles....are now available for laboratory use. They permit budget-conscious labs to make large numbers of peroxide & carbonate fusions.

37 °U. S. Industrial Chemicals

Construction Materials

Alloy.....Bulletin "Engineering Properties of Ni-o-nel" describes composition, physical and chemical properties & includes detailed information on applications.

56 *The International Nickel Co.

Alloys....Spraywelder process of hard surfacing stops excessive corrosion and abrasion. For further information on this hard-surfacing alloy, the Spraywelder Catalog is offered. BL289 "Wall Colmoney Corp.

Cable.....MI cable is ideally suited for all types of trouble areas. The many unique characteristics of this versatile cable construction in the new MI catalog. 110 *General Cable Corp.

Coating.....Carbo Zinc 11 is an inorganic zinc-filled coating which gives protection similar to galvanizing. Complete details are available on request. 235 *Carboline Company

Coating Systems.....Corrosion Data File includes a survey of corrosion problems in the Chemical Industry, data on Systems & a coating selector guide. 16-17 *Pittsburgh Chemical Co.

Coatings.....Technical data are available for information on various coatings such as Dimetcote No. 4, which is self-curing, Dimetcote No. 3 and Amercoat No. 99.

209

*Amercoat Corp.

Control Cables.....made with Tefion 100FEP resins provide unequaled reliability and minimize maintenance. Permit miniaturization of cables. Information.

201 *E. I. Du Pont de Nemours

Fabrication......Corrosion problems solved through resin bonded fiberglass construction. Process equipment such as ducts, stacks, hoods, etc. Facts in Bul. 101.

215 *du Verre, Inc.

Filter Fabrics....The handy information booklet, "Filter Fabric Facts" contains distributors names and answers problems related to your selection of filter fabrics.

113 "Wellington Sears Co.

^{*} From advertisement, this issue

Filter Media.... Information on filter media for effective dust collection is contained in Bulletin 14 entitled "Formula for Dust Collection" which is available.

R261 *National Filter Media Corp.

Filter Paper......custom-tailored to your process & your press. A 24page catalog on industrial filter papers gives complete details. Catalog 357. *Eaton-Dikeman Co.

Gasket Material.....Booklet describes "Armalon" felts & includes data on characteristics, detailed list of specific applications, & information on sizes & thicknesses.

75

Insulating Cement.....Super "66" insulating cement for temperatures up to 1800 F. Can be applied on irregular shapes. Descriptive material is offered.

88 *The Eagle-Picher Co.

Insulation Foamglas insulation is completely waterproof and is incombustible. Solves insulation problems above or below ground, indoors or outdoors. Data Sheets.

49 *Pittsburgh Corning Corp.

Packing.....Blu-Lon acid proof packing seals sulphuric, nitric and hydrochloric acids. Gives multicoat acid protection and savings in time, labor & money. R273 *A. W. Chesterton Co.

Pipe & Block Insulation New Kaytherm insulation is highly efficient to 1350 deg. F. For outdoor or indoor equipment for best long-life results. 2574 Keasbey & Mattison

Pipe Insulation Metal-On pipe insulation combines rugged jacketing with a locking device that snaps closed & seals joints. Doesn't corrode, needs no painting.

10-11 *De Laval Separator Co.

Refractory Castable.....Kaocrete-B is excellent for gunning in vertical or overhanging applications with low rebound loss, Bulletin R-35B is available. 133 *Babcock & Wilcox Co.

Rupture Discs.....Model CPV is designed for low pressure application while Model HOV is designed to operate closer to rupture pressure. Catalog is offered.

R284 *Fike Metal Products Corp.

Rubber Linings.....for tanks, pipe & process equipment. Permanent protection against corrosion & contamination. Permanent rubber-tometal bond. Cat. No. 7115.

60 *Rayestos-Manhattan, Inc.

Silicone Rubber.....Report discusses chemical reasons for versitility of material, presents specific properties and describes techniques used in fabrication. 257B Connecticut Hard Rubber Co.

Stainless Steel.....Armco 17-4 PH stainless steel offers excellent corrosion resistance. More specific information is available to help you cut costs.

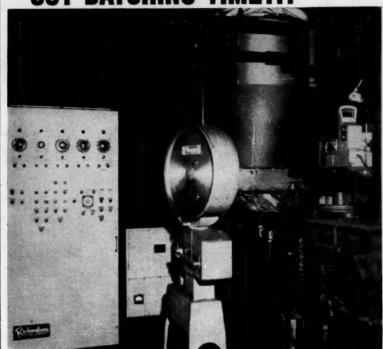
224 *Armco Steel Corp.

Stainless Steel.....New booklet "Producing Stainless Steels" is fully illustrated. It includes detailed sections on stainless steel plates, heads, forgings, etc.

66 G. O. Carlson, Inc.

• From advertisement, this issue

HOW DOW CHEMICAL COMPANY CIT BATCHING TIME



WITH RICHARDSON SELECT-O-WEIGH

It takes only two minutes now to precision-weigh a 600-lb batch of six hard-to-handle materials in the graphite department of Dow Chemical with Richardson Select-O-Weigh. Saves 8 man hours per shift over old semi-automatic system. Now they simply "dial" the formula at the control panel and calcined petroleum coke flour, coal tar pitch, ground green scrap, and two sizes of coarse calcined petroleum coke are weighed out automatically and emptied into the mixer. Panel adds liquid and powder additives separately; also features weight totalizers and over-under controls for each material. Higher production per man hour, lower costs, and automatic quality control all go with Richardson Select-O-Weigh. Get these benefits for your company, too. Write or phone Richardson Scale Company, Clifton, N. J.

RS-22

Send for free technical bulletin.



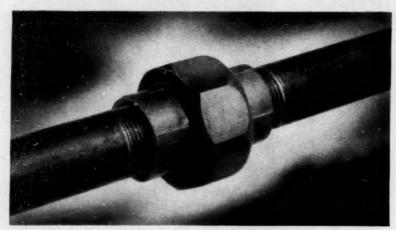


Sales and service Branches in Principal Cities. Also manufactured in England, France and Australia. Richardson Scales conform to U. S. Weights and Measures H-44 for your protection.

MATERIALS HANDLING BY WEIGHT SINCE 1902



You can SEE the difference on the shelf



You can TELL the difference on the line

with Rockwood Unions

In every way — from packaging through performance — Rockwood Unions are superior to competing brands. Yet they cost no more!

The differences in Rockwood Unions tell their higher quality story:
Rockwood Unions are boxed, the con-

Rockwood Unions are boxed, the contents clearly labelled and identified. Only Rockwood Unions have the hardness differential which assures fast, easy make-up, tight seal and freedom from galling. Only Rockwood offers four different seat types. Only tougher Rockwood Unions give you complete corrosion protection including "Rockwoodizing," the process that makes the threads and the entire surface of the union corrosion resistant. Longer serv-

ice life under severe line conditions . . greater resistance to vibration and shock . . . easier handling . . . Rockwood Unions give you all these advantages. Rockwood Unions are available in a wide range of sizes . . . all parts are interchangeable. Regardless of your needs, Rockwood Unions will do a better job for you. For complete facts write Rockwood Sprinkler Company, Union Department, 770 Harlow Street, Worcester 5, Mass. Distributors in all principal industrial areas. Rockwood Sprinkler Company, A Division of The Gamewell Company, A Subsidiary of E. W. Bliss Company.

ROCKWOOD

UNIONS

LITERATURE . . .

Tank Linings.....New Gar-Line Penton linings offer high-temperature protection against corrosion. Data on Penton; information on tank linings.

*Garlock Inc.

Wire Cloth.....Whatever metal or alloy needed in any size or quantities to the closest tolerances. High mesh counts are featured. An illustrated 120 pg. catalog. 84 "The Cambridge Wire Cloth Co.

Zinc Dust.....is now being used as a reducing agent, precipitating agent, purifier, catalyst, polymerizing agent, & in rust-resistant paints, bleaches, etc. Information. 95 *American Smelting & Refining

Electrical & Mechanical

Bar Hangers....Expandable bar hangers and bar hanger sets are described in Bulletin TOB-161 which is available on request. Ordering data are also included.

258A Appleton Electric Co.

Closed Circuit TV System.....Kin
Tel closed circuit TV systems consist of a camera, camera control
unit, & monitor, each connected by
a cable. Catalog 6-205.
139 *Kin Tel Div., Cohu Electronics

Couplings..... Fast's couplings come in a complete range of sizes & types for shafts from \(\frac{4}{n}\) to 32" and larger. Designed to outlast the machines they connect.

BR250 *Koppers Company, Inc.

Drive.....Ajusto-Spede drive is the answer to precise operating speeds for machine tools, process machinery, test equipment, windups, etc. Bulletins 2750 & 2800.

150 *The Louis Allis Co.

Elbows.....Type ELBD pulling elbows are made of heavy malleable iron with galvanized finish. Details are contained in Bulletin 12-25A which is available.

258B Appleton Electric Co.

Enclosures Spin Top enclosures are available in 4 sizes to include circuit breakers, across-the-line starters & combination starters. Details are offered.

115 *Square D Company

Engines.....4-page brochure describes operating characteristics of 12 or 16 cylinder supercharged LSV engine that can be provided for gas, straight diesel, dual fuel or tri-fuel. 258C The Cooper-Bessemer Corp.

Precision Switches.....20-page catalog covers a representative selection of precision switches for industrial, commercial, data processing, airborne and electronic applications. 258D Micro Switch Inc.

Rectifiers.....as well as complete semi-conductor power conversion equipment and systems for any AC to DC application. "Guide" to Industrial Rectifier Equipment. 65 "The Meaker Co.

Safety Heads......contain a thin metal disc which will rupture at a predetermined pressure to give complete & instantaneous protection. Further information.

226 *Black, Sivalls & Bryson

^{*} From advertisement, this issue

Silicon Rectifier Units.....are perfected & specifically designed for fast simplified conversion of existing mechanical or tube rectifiers. Details of unit offered.

90 *Buell Engineering Co.

Speed Reducers.....The 36-page illustrated Bulletin No. 410 contains complete information on these new speed reducers and is available on request.

57 **Cleveland Worm & Gear**

Turbines......Type YR turbines are tightly sealed against heat, cold, dust, fumes, rain & snow. Many key parts are interchangeable for various frame sizes. Bul. H22-D. 40-41 *Elliott Co.

Unilet.....ELBD unilet features new 90 deg. roller elbow. It's a time and cost saver for your more difficult wiring installations in hazardous locations. 1 *Appleton Electric Co.

Vertical Motors.....Two-page bulletin on integral horsepower vertical motors gives application information and mechanical features and a condensed dimension table. 259A Century Electric Co.

Handling & Packaging

Cylinders.....The new Hackney cylinder catalog, the most complete data file of its kind on modern cylinders for compressed gases is available on request. 4 *Pressed Steel Tank Co.

Dial Scales.....provide proved accuracy. Bench & portable dial scales available in capacities from 50 to 3200 lbs. Further information is available on request.

98 *Fairbanks, Morse & Co.

Feeders.....Rotary airlock feeders for use in handling problems of dust control and for pneumatic conveying. Bulletin P58 available upon request. BL261 *Prater Pulverizer Company

Gas Trailers.......feature cylinders, safety devices, controls, etc. in accordance with ICC requirements for your protection. Capacities to meet your needs.

BL291 *Independent Engrg. Co.

Industrial Weighing Equipment.....
Information on the full line of industrial weighing equipment from 1/100 oz. to 100 ton is available on request.

TC292 *Detecto Scales, Inc.

Loader.....Loads can be palletized or stacked in any pattern also put into warehouse storage. Literature and engineering details are available. BL287 *Power-Curve Conveyor Co.

Pneumatic Conveyors.....Bulletin describes four standardized conveyor systems with capacities of 1000 to 40,000 pounds per hour; includes selection and ordering instructions.

259B Sprout, Waldron & Co., Inc.

* From advertisement, this issue



Subsidiary of American Meter Co., Inc.

BUFFALO METER COMPANY, INC.

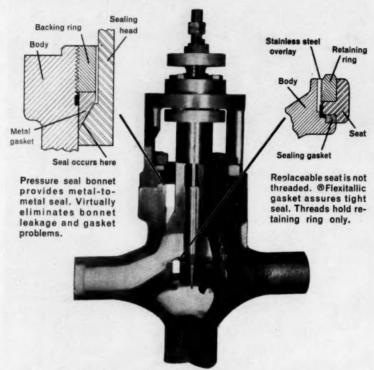
2917 Main Street, Dept. CE

Buffalo 14, N. Y.

SALES REPRESENTATIVES THROUGHOUT THE NATION



High pressure globe valve withstands pressure drops up to body ratings



Rockwell-Republic high pressure globe valves are available in 11/2", 2", and 3" sizes for 1500, 2500 and 4500 psi standards. In addition to removable seat and pressure seal bonnet, these valves are available with bolted bonnets and quick-change trim. For

more information about this and other Rockwell-Republic components and systems, just mail the coupon below.

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	☐ Process Transmitters		☐ Controllers
Computing Relays			Recorders
	☐ Drive Units		☐ V-5 Gauges
	ressure Reducing System	S	
☐ Electronic Control S	iystems	☐ Pneumatic	Control Systems
Vame		Title_	
Company			
Address			
City		Zone	State

LITERATURE . . .

- Scales.....have no knife edge pivots to wear and cause inaccurate weighing. Recommendations on improving or maintaining your improving or maintaining your competitive position are offered. R270 *Thayer Scale Corp.
- el Tanks.....Rubber-lined steel tanks and special equipment along with custom compounds for field application are described in Bulle-tin CE-53. 149a *American Hard Rubber Co. Steel Tanks.
- Trolley Conveyors......What trolley conveyors can do to reduce manufacturing and handling costs, and how to select the right one are the topics of a 58-page book.

 260A Link-Belt Co.
- Truck Scale.....Printweigh "400" automatically prints weight records in triplicate on certified weight certificates. Full details are contained in Bul. 2417.

 236 *Toledo Scale Co.
- rators.....4-page folder describes air, electric, gasoline and hydrau-lic powered vibrators for use on railroad hopper cars, chutes, bunk-ers and other applications. 260B Martin Engineering Co. Vibrators.
- Vibratory Feeders.....46-page catalog contains complete descriptions, specifications and data for line of small, heavy and extra-heavy duty vibrated feeders. Syntron Co.
- Weighing System.....Select-O-Weigh governs all components required for automatic formulation by weight of a product, liquid or solid, involving many ingredients.

 257 *Richardson Scale Co.
- Weighing Systems....Batch-Weighing systems offer consistent accuracy in any operation. Bul. 30 describes batch weighing systems & Bul. 14 automatic weighing systems.

 266 *Weighing & Controls, Inc.

Heating & Cooling

- Air Preheater.....Information on the Ljungstrom continuous regenerative principle, or on the Air Preheater that meets your requirements is available.

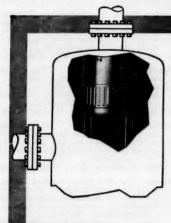
 227 *The Air Preheater Corp.
- at Exchanger......Stainless steel extended surface heat exchangers can be designed to your perform-ance specifications. Further in-formation is offered. 237 *Marlo Coil Co. Heat Exchanger.
- Heat Exchanger.....A detailed de-scription of Karbate impervious graphite heat exchangers Type CFB is presented in a new, 8-page Catalog Section S-6813. 111 *National Carbon Co.
- Heat Exchanger.....Selection of the right titanium heat exchanger is a sure-fire way of controlling your costs. Performance data & fabrication are offered.

 249 *Titanium Metals Corp. of America
- Heat Exchangers Brazed Alumint Exchangers......Brazed Aumini-um surface consists of corrugated aluminum sheets brazed together to form a stack of layers that pro-vide individual passages. Facts. 22-23 *Trane Co.

[•] From advertisement, this issue

PROTECT

STEAM EQUIPMENT PROCESSES



with

Anderson Hi-ef Purifiers

Hi-eF Purifiers are guaranteed to remove a minimum of entrainment in all steam processes. Deliver clean, dry steam under virtually all conditions. Write for Bulletin 804 containing complete specifications on 13 different separators, scrubbers and mist extractors.



Hi-eF PURIFIER

By the Manufacturers of Super-Silvertop Steam Traps

THE V. D. ANDERSON COMPANY

Division of International Basic Economy Corporation 1943 W. 96th Street Cleveland 2, Ohio

PRATER — the recognized leader

ROTARY
AIRLOCK
FEEDERS

for
DUST CONTROL
and
PNEUMATIC
CONVEYING

WRITE FOR BULLETIN PSB

PRATER PULVERIZER COMPANY
1517 South 55th Court • Chicago 50, Illinois

The NATIONAL FILTER MEDIA CORPORATION PRESENTS Formula for Dust Collection





Weavers of Industrial Filter Media for over Fifty Years

THE

NATIONAL FILTER MEDIA CORP.
GENERAL OFFICE and MILLS
NEW HAVEN 14, CONN.
WESTERN OFFICE and Factory
SALT LAKE CITY 10, UTAH

big reasons why Pennsalt chose the Stokes tornado mill...

Versatility

in speed, in size of particles it handles, in the rate of production, in the different basic materials with which it can be used

Portability

Pennsalt uses it in several different locations throughout the plant

· Easier-To-Clean

Tornado Mill can be cleaned in 1-hour. It formerly took a full day to clean the size reduction equipment

• 360° screen provides full working area

 Minimum Maintenance Only two spare parts required

> Pennsalt uses the Mill in size reduction of dry Sal Ammoniac and dry Actidip*.

> Whatever you are contemplating, investigate the Stokes Tornado Mill. More and more companies everyday are learning the new way to "size reduce".

> The Stokes Advisory Service will be glad to run tests on a sample of your material. Call or write . . . today.

*Registered traden

Size Reduction Equipment Division F. J. STOKES CORPORATION 5500 Tabor Road, Philadelphia 20, Pa.



LITERATURE . . .

Heat Exchangers.....to solve many problems of cooling under intense pressures for many types of chemical, petroleum and petrochemical applications, Bulletins offered.

264 *The Vilter Mfg. Co.

Heater, Fired.....Petrochem Vertical and Horizontal Heaters can be built in every size and type for every use in any location. Complete details are available.

89 *Yuba Consolidated Industries

Liquid Phase Heater.....The Vapor Modulatic Hi-R-Temp phase heater is a forced circulation, colled tube, direct-fired heater of two-pass design. Bul. No. 4023.

153 *Vapor Heating Corp.

Make-Up Air Systems.....Fans bring in outside air, and heaters temper it. Cancels out vacuum, gives bal-anced heat & ventilation. A book-let is available. 79 *Sturtevant Div., Westinghouse

ens......Forced-convection ovens solve the big problems in today's research & industrial laboratories. They eliminate hot & cold pockets. Information in Bulletin 519-500. *American Instrument Co.

Rotary Indirect Air Cooler.....3'-6" dia. 18'-6" long. This unit is unique in that no air for cooling is in with the product, consequently no dusting. Catalog.

TL291 *Davenport Machine & Foundry

Steam Traps.....Series 130 is an all-in-one combination steam trap, strainer & blow-down valve. For moderate condensate load applica-tions. Bulletin T-1743-B. 93a *Yarnall-Waring Company

Steam Traps, Impulse......Series 30 impulse steam traps offer economy of operation with close condensate control. Further information in Bulletin T-1743.

93b *Yarnall-Waring Company

Tank Heater feature steel tubes, aluminum fins and high heating efficiency. Full details and complete rating data for all sizes of tanks in Bulletin 1623.

197 *Griscom-Russell Co.

Vacuum Refrigeration.....Chill-Vac-tor comes nearest to natural re-frigeration. No chemical refriger-ant or absorbent to leak, corrode or crystallize. 242 *Croll-Reynolds Co., Inc.

Instruments & Controls

Analog Computer Systems Model 231R analog computer systems can be used for new process research & development, process equipment design, etc. Information is offered. 255a *Electronic Associates, Inc.

.GE-312 computer control system embodies adaptability and flexibility to meet many types of applications. Furth-er information is available. General Electric

stroller.....Series 532 pneumatic recording controller is outstanding-ly simple, reliable and stable. De-signed for batch-type & continu-Controller. ous processes. Data.

*The Bristol Co.

• From advertisement, this issue

- Controller....Compact instrument for accurate, automatic, two-position control of up to 10 industrial processes is described in 8-page Instrument Section No. 52.

 263A Thermo Electric Co., Inc.
- Controls.....Bulletin 91051 is a condensed catalog showing valves, cylinders, pumps, accessories and special controls plus a list of sales representatives.

 263B Airmatic Valve, Inc.
- Controls.....Temperature indicating and control equipment assures complete reproducibility of results. Various instruments available are described in booklet.

 263C Control Indicating Corp.
- Controls......Instrumentation, both pneumatic and electronic plus engineering and service. The complete story on this can be found in Bul. 13-18.

 14-15. *The Foxboro Co.
- Data Logger.....A low-cost automatic data logger built as an integrated scanning, measuring & printing system—the RS2 Recording Digital Voltmeter—is now in production.

 *Non-Linear Systems, Inc.
- Flow Transmitter... New Bellows flow transmitter gives you field indication plus convenience and precision. Complete details are available on request.

 88 *Minneapolis-Honeywell
- Flowmeter.....Two new models of the turbine flowmeter, propeller type flowmeters that transduce liquid velocity to a millivolt signal, are described in specification bulletin.

 263D Fischer & Porter Co.
- Gauges.......Completely automatic gauges can be located as far as 250 ft. from tanks. Simple to install & requiring no maintenance. Details are offered.

 286 *The Liquidometer Corp.
- Instrument. Model 77 Continuous Turbidimeter-Colorimeter for measuring color in continuous streams. Consists of an Analyzer Unit & Control Unit. #14-16-13.

 R285 *Beckman Instruments, Inc.
- Instruments..... Descriptions of the various models of differential pressure instruments are contained in Bulletin G1-1 which is available on request.

 263E Barton Instrument Corp.
- Magnetic Gages.....are available in four models to fit a variety of installation needs. Full details about these accurate and safe gages in catalog.

 135 *Jerguson Gage & Valve Co.
- Meter Clamp.... Varea-meter external clamp is a simple but effective lever-type clamp which gives positive tube-locking force. Further information is available.

 218 *Wallace & Tiernan, Inc.
- Meters......Niagara meters simplify handling and control of corrosive & standard liquids. For use with any liquid from water to solvents to sulfuric acid. Bulletin 48.

 259 *Buffalo Meter Co.
- Meters.....Instruments that measure and control flow temperature, pressure, etc. in a wide variety of types for different operations. Booklets offered, 20-21 *Fischer & Porter Co.

here's why most plant engineers prefer WEINMAN PUMPS

Handling of liquids . . . for heating, cooling and processing . . . is an important facet of modern manufacturing. The tremendous volume of fluids handled prompts today's industrial engineer to find ways of insuring a steady flow of vital liquids to and from the job. That's why more and more engineers are turning to Weinman to meet their precise pumping requirements. And, they find plenty of reasons to back their buying decision:

- WEINMAN EXPERIENCE. More than 50 years of pioneering developments that are today's standards assures you of the right pump for each job.
- 2 COMPLETE PUMP LINE. Every type of centrifugal pump to meet any pumping need. You're sure that the pump you buy is the best pump for the job.
- 3 QUALIFIED RECOMMENDATIONS. Made after a careful analysis of your present and future pumping needs. You get the pump that fits your job today and tomorrow.
- 4 SIMPLE DESIGN AND RUGGED CON-STRUCTION. Weinman Pumps are built for easy maintenance and long, troublefree service.
- 5 INSTALLATION AND SERVICE. You get skilled assistance before, during and after installation to insure proper operation twenty-four hours a day.

When you're faced with a pumping problem . . . get the right answer from your Weinman specialist . . . you'll find his name in the Yellow Pages. Or, write to us.

Immersible Non-Clog Pum





^{*}From advertisement, this issue

Vilter custom-designed Heat Exchanger helps produce high-energy missle fuel

Vital chemical processes, today, require the utmost in ingenious, reliable equipment.

Typical of Vilter's contribution to America's strength and progress is the heat exchanger shownan original Vilter design.

Custom designed to aid the production of solid boron fuel, this vessel is fabricated entirely of stainless steel. Separate condenser and receiver sections have been assembled into a single unit, ASME coded to -70° F., with propane used as refrigerant. Vilter designed, built and installed this unit to exacting design require-

Another example of the specialized vessels and heat exchangers Vilter designs and builds is the lean glycol amine solution cooler shown below. This kettle type, flooded Refrigerant-12 cooler has a floating head and removable tube bundle. 1140 square feet of heat transfer surface is contained in a 36" O.D. by 23 ft. long shell.



Used in the production of solid boron fuel, this combination condenser receiver assembly is over 20 ft. high.

23 ft. long lean glycol amine solution cooler.

Vilter has successfully solved many problems of cooling under intense pressures, and has designed and produced hundreds of heat exchangers, pressure vessels, and high pressure synthesis condensers to exacting specifications-explosion proof if necessary-for many types of chemical, petroleum and petrochemical applications.

Many leading names in industry look to Vilter for their special refrigeration, heat exchanger and vessel needs. Why not consult with Vilter about your problem?





LITERATURE . . .

Meters.....A 28-page technical bul-letin lists liquids, helps pick proper sizes and features meters 2 to 2000 gpm. This Bulletin 566Q is availgpm. This Bulletin able on request. *Neptune Meter Co.

Meters.....guard your liquid inven-tories and control the flow of in-dustrial liquids. You'll have ac-curate records of costs plus other *Rockwell Mfg. Co.

ers......Advantages of both ro-tary-positive-displacement meter-ing & line-mounting in a 7000 cfh Rootsmeter, Model 7M125 as well as the 3000 cfh model. Details. 59 "Roots-Connersville Blower

Nuclear Gaging System......Bulletin describes system for measuring level or interface position of liquids, solids or slurries—includes diagrams for six types of applications. 264A The Ohmart Corp.

Pneumatic Controls..... Almost limit-less in application, with a wide range of styles, sizes, strokes & capacities. Details are contained in Catalog GC-A. 221 *Robertshaw-Fulton Controls

a true primary and transmitted signal for indication or control. Factful Bulletins 360 and 361 can help you in your selection. Manning, Maxwell & Moore, Inc. Pneumatic Transmitters.

process Control Computers Analog process control computers can be used for metal refining & forming, chemical processing, petroleum refining, etc. Information.

255b *Electronic Associates, Inc. **Process Control Computers.**

with the 202A flow recorder. It is compact and ruggedly built and has built-in overrange protection. Bulletin 202A-1 is offered. 216 *Barton Instrument Corp.

Recorders.....The tremendous power of the 90J (pneumatic) and the 700J (electronic) recorders gives you greater accuracy than ever before. Bulletins 98286 and 98335.

136 *Taylor Instrument Companies

Switchboard Instruments.....Bulletin describes new low cost, one per cent accuracy, type AB-30 and DB-30 switchboard instruments that offer savings of 10 to 20 per cent. 264B General Electric Co.

Tank Gaging System.....are expected to provide 70 to 1000 thousand hour of service with no electronic or mechanical maintenance. Sys-tems are simple & economical. 213 "E.actel Instrument Co.

Temperature Regulator.....available in sizes ½" to 4". Temperature ranges as low as 15 F. to 50 F.— as high as 240 F. to 350 F. In-formation in Bulletin 114A. *Manning, Maxwell & Moore, Inc.

Transmitter....Transcope differential pressure transmitter with Barton meter body for high accuracy & trouble-free measurement. Details trouble-free incapanies in Bulletin 98362.
*Taylor Instruments

Viscometer Receivers. ...for use with viscometer measuring elements are described in a new bulletin which has been prepared and is available on request. Bul. V-1240. Norcross Corp. Norcross Corp.

* From advertisement, this issue

We're experts in the Fabrication of Titanium



Welding 3/4" titanium plate on STANDARD'S modern equipment.

STANDARD makes complex weldments for the chemical and missile industries ... pressure and heat applications to ASME Code specifications in titanium, the metal that is revolutionizing many processes. Let STANDARD help you take advantage of titanium's corrosion immunity, anti-fouling characteristics, and heat resistance. We are specialists in the art of fabricating equipment from titanium plate, sheet, and tubing.



STANDARD STEEL CORPORATION 5005 Boyle Avenue, Los Angeles 58, California Cambridge Division, Lowell 5, Massachusetts Leader Iron Works, Decatur 5, Illinois



HIGH EFFICIENCY. Multiple small-diameter collectors—a WP-pioneered feature—generate greater centrifugal forces for higher separating efficiency.

MORE ECONOMY — all along the line. Basic cost, installation, housing, maintenance all are less. No costly, complicated ducting. Highly adaptable units can often be fitted into existing structures. No moving parts — and cast iron tubes and vanes last.

MORE INFORMATION? For literature, write Western Precipitation, 1000 West 9th Street, Los Angeles 54, California. (In Canada write 8285 Mountain Sights Avenue, Montreal, P.Q.)

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RESEARCH DEVELOPMENT

REQUIRES THE BEST MIXING, GRINDING & DISPERSING EQUIPMENT



#130EL—2gal, variable speed Double Planetary Change Can Mixer—1 qt.—150 gal, sizes.

#130EL — 1 gal. vacuum tight Mixer. Available with stainless steel seamless jacketed cans and up to 1 HP exp. prf. motor drive.





#41A—1 Pt. Double Arm Kneader. Easy to clean, jacketed, and with vacuum cover when required. 1 Pt.—150 gal. sizes.

#52LC-4½"x10".

Three Roll Mill with water cooled rolls, one point adjustment and quick roll release. 2½" x 5" - 16" x 40" street.



#70—H size 4 Dry Grinding Mill Variable speed drive, with 1" feed size ground between 16" and #100 mesh as required. Many sizes including other type Disintegrators, Crushers and Pulverizers.

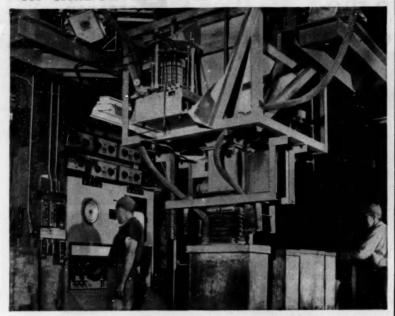


production sizes.



CHAS. ROSS & SON CO., INC.

Leading mfgrs. of wet or dry grinding Mille, Knowders and Mixers of all types — since 1867, 150 CLASSON AVE., BROOKLYN 5, N. Y.



Accuracy and Instantaneous Control Response with W&C BATCH-WEIGHING SYSTEMS

Critical formulation standards are maintained at lower cost since Carborundum Company has introduced automatic batching of ingredients at their Perth Amboy, N. J. refrac-tories manufacturing plant. The new automatic system—designed with W & C pre-engineered and laboratory-tested "building block" components has greatly increased production, reduced labor costs, and decidedly improved the accuracy of batch weight control.

Chief reason for the accuracy of W & C Batch-Weighing Systems is the pat-ented Uniforce flexural frame used in supporting both weigh-hoppers and weight transmitters. These unique flexural frames ensure accurate weighing under all load conditions, resolve every force and moment into a single vertical component applied to the load transducer.

Immediate response to control material flow in any batching operation is provided by the W & C Pneumatic Weight Transmitter, a force-balance instrument delivering a highly reproducible, (1 part in 2000) almost instantaneous signal directly proportional to net weight. No possibility of overshooting specified ingredient quantities. Practically no maintenance, compared with mechanical systems. The W & C scale is dynamically faster than a beam-andbalance or flexural beam system . . . W & C uses air, has no inertial mass to overcome . . . comes into balance sooner than a mechanical system.

For consistently accurate reproduction of bulk material formulations in any batching operation-single ingredient weighing to sequential multi-ingredient proportioning—you can depend on W & C.

WRITE FOR BULLETINS

Bulletin 30 fully describes W & C Batch-Weighing Systems Bulletin 14 describes other W & C Automatic Weighing Systems



CONVEYOR SCALE SYSTEM



CONSTANT-FEED WEIGH-HOPPER SYSTEMS



SYSTEMS



CONTROL PANELS



Weighing & Controls, Inc. Subsidiary of CompuDyne Corporation Industrial Park, E. County Line Road, Hatboro 10, Pa.

LITERATURE . . .

Pipes, Fittings & Valves

Ball Valve.....Useful information con-cerning the Petro ball valve is contained in Bulletin 61-B. A cor-rosion chart & pressure tempera-ture chart are included. 266A Clayton Mark & Co.

Fittings, Flanges & Unions.....Folder PF-2 contains complete data on quantities & weights of the items as packaged in various sizes of cartons. *Henry Vogt Machine Co.

Fiexible Connectors.....A-X fiexible metal connectors are designed to handle many types of movement. Complete details are contained in Bulletin A-X97 which is offered 58 *Anaconda Metal Hose

ries......Turret nozzles fight fires from any angle. Every type is de-signed to fight fire four ways: with solid FOAM, FogFOAM, WaterFOG and solid water stream. Bkit. 100 *Rockwood Sprinkler Co.

e......Saran Lined Pipe for carrying even the most corrosive of chemicals. Can be cut, modified and fitted in the field without special equipment. Information.

*Dow Chemical Co.

Pipe, Glass......Kimax glass pipe is indifferent to the attack of most acids and alkalis and is economical in installation and maintenance. 155 *Kimble Glass Div. of Owens-Illinois

Pipe, Pyrex.....comes in all standard sizes and fittings. You can see through the pipe wall into the flow area. Further information in Bul-letin PE-3.

*Corning Glass Works

Pipe, Steel.....Yoloy steel pipe resists corrosion better than wrought iron or carbon steel. It is able to resist the corrosive bite of atmosphere, soil & chemicals.

34-35 *Youngstown Sheet & Tube Co.

Pipe & Fittings..... Hard rubber pipe and fittings, including heat-re-sistant Tempron for handling hot corrosives are described in Bulle-tins CE-51/52 and 96.

*American Hard Rubber Co.

Pressure Tubing..... Electricweld tub-ing is made of the finest carbon steel. Provides uniform outside diameter, wall thickness and con-centricity.

103 *Jones & Laughlin Steel Corp.

Steel Pipe.....Rubber-lined steel pipe combines strength of steel with chemical resistance of Ace Hard Rubber. Bulletin CE 51/52 is avail-*American Hard Rubber Co.

Tube & Pipe.....Reliability with true economy is built in—inside and out—with Fibercast. Available for all lines from 2" tubing through 8" pipe. Information. 87 °Fibercast Company

Tube, Heat Exchanger....for applications from marine to petrochemical, from compressor intercoolers to "cat-cracker" exchangers in many popular alloys.

105 *Scovill Manufacturing Co.

• From advertisement, this issue

- Unions.....have the hardness differential which assures fast, easy make-up, tight seal & freedom from galling. Four different seat types. Facts are offered.

 *Rockwood Sprinkler Co.
- Valve.....New Sampling Valve cannot clog. Designed for simple installation in existing systems, merely by welding a ¾" half coupling into the pipe or vessel. TR292 *Strahman Valves, Inc.
- Valves......DEMI miniature packingless valves offer great porting versatility in isolating, routing & by-pass applications. Catalog D-1 is offered for details. BL273 *G. W. Dahl Co., Inc.
- Valves......Sleeveline valves are 5 ways better. They offer larger sealing area, better adjustment, no pocket to collect liquids & solids & economy. Bul. V/14.

 207 *Duriron Co., Inc.
- Valves......for fast, easy opening and closing with a leak-proof seal & straight-through flow with minimum pressure drop. Informative bulletin is available.

 164 *Everlasting Valve Co.
- Valves.....Operation from full-open to full-closed is accomplished in one-half second with these noncorrosive ball valves made of plastic. Informative *Kraloy-Chemtrol Co.
- Valves......Forged steel valves are available on all lines up to 2 in. Designed to meet control requirements with minimum replacement & maintenance. Information. 217 *Ohio Injector Co.
- Valves & Actuators......The mix & match versatility of these valves & actuators lets you select the degree of performance you desire. "Valve Size Computer" offered.

 28-29 "Minneapolis-Honeywell
- Valves, Ball......New catalog gives complete data on all types of ball valves. Includes dimensions, materials and corrosion resistance data. Available on request. 129 °Hills-McCanna Co.
- Valves, Ball......Type DZ Fire Safe ball valves offer many advantages such as no lubrication, quarterturn operation, economy and compactness. 2674 Jamesbury Corp.
- Valves, Ball.....are available in carbon steel to ASA 300 lbs. (some sizes 600 lbs.), and in semi-steel, ASA 200 and 400 lbs. WOG. Catalog 1000 for further information. 91 *W-K-M Div. of ACF Industries
- Valves, Control.....LB control valves feature tight shutoff, simplified construction, lower maintenance, split body, fast delivery and much more. Literature is offered. 74 *Conoflow Corp.
- Valves, Diaphragm....resist attack by hot corrosives. The diaphragm lifts high for stramline flowseals tight for positive closure. Further information. 76 *Grinnell Company
- Valves, Gate.......Special stainless steel gate valves are meeting the most precise demands of nuclear services. Detailed information is available. *Darling Valve & Mfg. Co.

* From advertisement, this issue

NEW DURABLE KATHABAR® SYSTEMS

offer high performance with new low maintenance for years of troublefree service



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Rugged new Kathabar design provides all-nickel regenerator, separate from rest of system, to prevent condensation corrosion. Breaking all records for low maintenance, all over the world.

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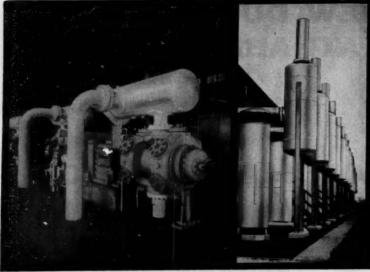
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Consulting engineers like the Kathabar system: no re-heat, no frost, no chemical carryover. Humidity, independent of dry bulb, controlled with no reversing or interruption for regeneration.

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FLIMINATE H BURGESS-MANNING SNUBBERS

Burgess-Manning Pulsation Snubbers are the most effective control measures available to eliminate pulse-induced vibration. Equipment performs better, operating and maintenance costs are reduced, breakdowns and repairs are fewer, and even structural damage to buildings and foundations is prevented. Similarly, when a Burgess-Manning Silencer is installed to eliminate excessive noise, employees work more efficiently, with fewer accidents and errors, production is usually increased, and a plant's labor and community relations are improved.

If noise or vibration from the intake or discharge of internal combustion engines, blowers, turbines, compressors, gas or steam vent valves, pressure regulators, and similar equipment is a problem with you, contact Burgess-Manning. Nowhere in the world will you find a company better qualified, with more experience, a better engineering background, and a wider range of products for noise and pulsation attenuation. Pictured: Burgess-Manning Pulsation Snubbers, Filter-Silencers, and Exhaust Silencers on gas-driven compressors in petroleum pipe line station.

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Valves, Plug......keep viscous prod-ucts flowing economically. Long on service while short on maintenance. Information is contained in Buletin J-57.

9 *Hetherington & Berner, Inc.

LITERATURE . . .

ves, Safety Relief......have a special "O" Ring Seat Seal that stops leakage completely. Available in both Standard & Balanced Bel-lows design. Bul. 1940 & Cat. 1900. "Manning, Maxwell & Moore, Inc.

ves, Solenoid......Complete information on all models available. Also a 16-page brochure which lists over 500 corrosive media...coded for correct valve selection.

R271 *Valcor Engineering Corp.

Valves, Stainless Steel......All the features of these stainless steel valves are covered in the Stainless Steel Ca'alog No. 59SS which is available on request. *Jenkins Bros.

Process Equipment

Agitators.....Tank Top agitator gives dependable, rugged agitation at low initial and operating cost. Bulletin 581 gives further information and is available. *Nettco Corp.

Centrifugal......Continuous Solid Bowl type for lost cost solid-liquid separations involving moderate volumes, or limited space or extra powerful separating forces. Details. 2 *Bird Machine Co.

Centrifugals......Batch-Master cen-trifugals combine rapid bottom un-loading with inherent stability of patented Center-Slung suspension. Illustrated bulletin. 247 *American Machine & Metals, Inc.

Centrifuges Fletcher-Matic centrifuges are practically self-operating. Tornado-Matic and Suspend-O-Matic models are described in Bulletin 202-560.

77 *The Sharples Corp.

Contactor Vapor-liquid contactor offers liquid atomization, millisecond contact time, enormous interfacial contact area and positive single pass action.

147 *Stratford Engineering Corp.

stallizers New Draft Tube Baffle crystallizers are the most advanced yet designed for produc-tion of large, uniform crystals. Details in Bul. SW-206. 223 *Swenson Evaporator Co. Crystallizers

pactness, appearance, performance and economy. Has lower housing and complete accessibility of all parts. Bulletin 462.

*Practor 4: 5.4.

Dust Collector Multiclone me-chanical dust collector traps more dust at less cost. Literature may be had upon request for more in-*Western Precipitation

Dust Control Equipment......works quickly and efficiently to reclaim valuable dust for you. Equipment for all your needs is available. All for all your needs the facts on request.

*Pangborn Corp.

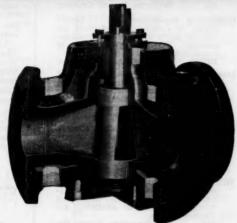
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KEEP VISCOUS PRODUCTS FLOWING **ECONOMICALLY**

- . WRENCH OR AIR CYLINDER **OPERATED**
- SPRING LOADED
- . NON-LUBRICATED
- ALL SIZES
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LONG ON SERVICE... SHORT ON MAINTENANCE

H & B's fully jacketed spring loaded plug valves feature an inverted tapered plug inserted and lapped into the housing from the bottom of the valve—then spring loaded. The spring wedges the plug to a perfectly tight seal, eliminating troublesome leaks. Easy to operate—no big handwheel... no freeze...no "breaking loose" necessary. Easy to clean. Made in straight, angle, or multi port design.

For complete jacketed systems, send for Bulletin J-57

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SUTORBILT BLOWERS FOR METERED. OIL-FREE AIR AND GAS HANDLING

Sutorbilt Series 3200 Blowers and Gas Pumps for large capacity air requirements.

One-piece shafts, precision machined helical timing gears, and special timing hub are a few outstanding features recommending Series 3200 blowers and gas pumps for chemical plant applications where equipment must operate continuously against varying pressures.

Absence of internal lubrication insures the delivery of gas or air free from contaminating lubricants. As a positive dis-placement blower, the Sutorbilt unit delivers a metered amount of air measured at inlet conditions with each revolution.

Rated from 800 to 23,000 cfm at pressures from 2 to 12 psig, these heavy-duty units are available with timing gears from 10" to 26". Standard equipment includes machined sub-bases, reversible oil pump with oversized oil sump, and lip-type oil seals (mechanical seals in gas and vacuum pumps) to prevent leakage and gas contamination. Vertical and horizontal types available in many sizes in both series. Write today for Bulletin No. S-32-A.

Sutorbilt Blowers for smaller capacity requirements - Cali-fornia Series B Blowers...for

higher speeds, greater outputs.
Thrust bearing on drive shaft
permits V-belt or direct drive. Steel timing gears for extra long service. Dynamically bal-anced impellers for high-speed operation. Write for Bulletin S-59-I, Dept. A.

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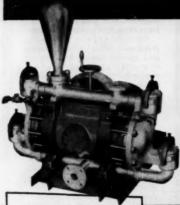
66 EAST VICTORIA ST. . COMPTON, CALIF. Subsidiary of Fuller Company . Catasauqua, Pa.

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DIAPHRAGM PUMP

· LOH OPERATING COST · LOW MAINTENANCE COST . LONGER SERVICE LIFE · EASY TO CLEAN

Thousands of Shriver pumps handling materials that clog or wear out other pumps all too quickly have proved their amazing service economy record. It will pay you to get Bulletin 148.

T. SHRIVER & CO., Inc.

LITERATURE . . .

st Filters......The Dynaclone op-erates continuously & provides 20 to 40% more cloth. Automatically self-cleaning by reverse air. The 36-page Catalog 104 offered. 288 *The W. W. Sly Mfg. Co. Dust Filters.

Dust Recovery Equipment...... Cy-clones, scrubbers and filter for almost every dust control applica-tion. They are efficient, economical. Bulletin A-9159. 64 *The Ducon Company

Filter, Horizontal......Feinc horizontal filters are custom designed for any continuous separation of free-filtering or free-settling materials. Information.

232 *American Machine & Metals

Filters......Operating with process streams from 5 to over 1,000 gal. per minute, Niagara filters can be adapted to automatically process hundreds of materials.

246 *American Machine & Metals, Inc.

ers......Economical and efficient filtration is detailed in two specifi-cation data sheets that includes engineering specifications, and con-struction advantages. 270A B-I-F Industries

er Aids......Bulletin B-14 dis-cusses the principles and operating practices of filteraid filtration and its applications in many industries. Available on request. 33 *Great Lakes Carbon Corp. Filter Aids

Gravity Filter.....Brochure describes automatic valveless filter and in-cludes layout drawings for municipal type filter with a chart of sizes and capacities.

The Permutit Co.

Hammer Mill......with extra heavy manganese steel liners & breaker plates, oversize shafts, massive parts & reinforcements which defy shock & wear. Catalog.

101 *Williams Patent Crusher

Liquid-Gas Separation.....Liqui-Jector is easily installed with no moving parts and minimum main-tenance. Further information is contained in Bulletin 84. BR292 *Selas Corp. of America

Liquid Filters......Fine mesh liquid filters stop downtime, damaged equipment, contaminated products, customer & management complaint. Non-short circuiting design.

BL285 *Ronningen-Petter Co.

eronizers......grind and classify in one operation in a single chamber. Provide fines in range from ½ to 44 microns. Eight models available. Micronizers.....

Nibro-Energy mill wet-grinds particles from 60 mesh to one micron or smaller. An illustrated technical paper is available for further details.

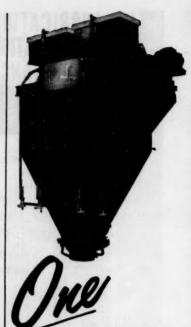
*Southwestern Engrg. Co.

Mixers.....Catalog describes complete line of mixing, blending and agitating equipment and gives complete data for the selection and application of mixing equipment.

270C J. P. Devine Manufacturing Co.

Mixers Adaptioneered mixers fer the best results in smallest space at the lowest cost. Horizontal, and continuous mixers are available. 254 *Sprout, Waldron & Co.

• From advertisement, this issue



YER SCALE PULLS LARGE FEED MILL OUT OF THE RED

> Accuracy increased and handling costs reduced

Now ONE Thayer Bagging Scale does the same job that formerly required 3 conventional scales — and does it better. Weighing and bagging of feeds with different handling characteristics is automatically accomplished by simple editistication. adjustments on the Thayer Scale. The new, more accurate system has eliminated losses caused by overweight bags.

Unlike conventional scales, the Thayer Scale has no knife edge pivots to wear and cause inaccurate weighing. The Flexure-Plate suspension system of the Thayer Scale cannot wear, requires no maintenance, and accuracy is guaranteed for millions of weighings.

Call or write Thayer Scale for recommendations on improving or maintaining your competitive posi-tion through precise weight control.

BAGGING, BATCHING, METERING,
CHECKWEIGHING and
CUSTOM DESIGNED SCALES.



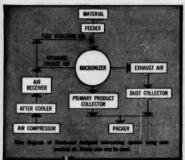
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Need ½ to 44 Microns?

Sturtevant Micronizers* Make 325 Mesh Obsolete





One Operation Reduces, Classifies

Sturtevant Micronizers grind and classify in one operation in a single chamber-provide fines in range from 1/2 to 44 microns to meet today's increased product fineness needs. Can handle heat-sensitive materials.

No Attritional Heat

Particles in high speed rotation, propelled by compressed air entering shallow chamber at angles to periphery, grind each other by violent impact. Design gives instant accessibility, easy cleaning. No moving parts.

Classifying is Simultaneous

Centrifugal force keeps oversize material in grinding zone, cyclone action in central section of chamber classifies and collects fines for bagging. Rate of feed and pressure control particle size,

Eight Models Available

Grinding chambers range from 2 in. diameter laboratory size (½ to 1 lb. per hr. capacity) to large 36 in. diameter production size (500 to 4000 lbs. per hr. capacity). For full description, request Bulletin No. 091.

Engineered for Special Needs

A 30 in. Sturtevant Micronizer is reducing titanium dioxide to under 1 micron at feed rate of 2250 lbs. per hr. For another firm, a 24 in. model grinds 50% DDT to 3.5 average microns at a solid feed rate of 1200-1400 lbs. per hr. A pharmaceutical house uses an 8 in. model to produce procaine-penicillin fines in the 5 to 20 nicron range. Iron oxide pigment is being educed by a 30 in. Micronizer to 2 to 3 verage microns.

Sturtevant will help you plan a Fluid-Jet system for your ultra-fine grinding and classifying requirements. Write today.

Can Test or Contract Micronizing Help You?

Test micronizing of your own material, or produc-tion micronizing on con-tract basis, are part of Sturtevant service. See for Sturtevant service. See for yourself the improvement ultra-fine grinding can contribute to your product. Write for full details. STURTEVANT MILL CO., 100 Clayton St., Boston, Mass.



LITERATURE . . .

Mixing ColumnCMContactor new multi-stage mixing column handles anything that flows. Combines a mixer and process vessel, designed to fit your needs.

294 *Mixing Equipment Co.

lling.....Simpson Mix-Muller is specifically designed to put you in control of mixed properties. The Handbook on Mulling is available on request.
163 *National Engineering Co.

Process Centrifuges.....perform separations of types and efficiencies not previously possible. A booklet on centrifuge types and their applications is available.

8-9 *De Laval Separator Co.

Process Equipment.....Technical information on Homogenizers, Sub-Micron Disperser, Triplex Pumps etc. is contained in bulletins that are available.

*Manton Gaulin

Purifiers.....Hi-eF purifiers can be relied upon to give outstanding performance. Bulletin 804 contains specifications on standard type plus engineered units. TL261 *The V. D. Anderson Company

C Column..... combines many advantages such as high volumetric efficiency, high throughput capacity, elimination of interstage settling, etc. Bul. #T-1159.
94 *Gen. American Transportation RDC Column ...

ubber Interphase Flooded-Bed scrubber is a compact, integrated unit. Construction is corrosion proof & provides easy access for servicing. Information. 228 **John Wood Company

Spray Nozzles.....Catalog 24 contains
48 pages of reference data on
thousands of spray nozzle designs
and sizes. Choice of capacities,
characteristics & materials.
TL 285 *Spraying Systems Co.

Steam Jacketed Kettles....meet every processing & mixing need. Size & type for every process or product are covered in book of engineering data & specification sheets.

L292 *Groen Mfg. Co.

Vacuum Tumble Dryers.....Catalog 16-P contains complete technical information on vacuum tumble dryers, Twin-Shell blenders and the new solids-processor. 118-119 *Patterson-Kelley

Pumps, Fans & Compressors

Air Compressor....features air power, efficiency at all key points, perfect running balance and low, low maintenance. Full details are contained in Bulletin 185.

67 *Clark Bros. Co.

Air-Conditioning Systems Katha-bar systems offer sterile air and dry surfaces as special advantages to specifying engineers. Facts available. 267 *Surface Combustion Corp.

wers.....for metered, oil-free air and gas handling. Series 3200 for large capacity air requirements. Further information is contained Further information in Bulletin S-59-I.

*Sutorbilt Corp.

· From advertisement, this issue



up to 150 psi. Nylon seat outlasts steel. Infinite varieties available... lists as low as \$10.75.



VALCOR Series SV-5100 Specifically designed to handle the most corrosive media in industry. Manufactured in Teflon, PVC and Nylon varieties. Diaphragm construction prevents media contact with any metal. Available in direct-acting or piloted models.

FREE...new 16 page brochure — lists over 500 corrosive media — coded for correct valve

For complete information on these or other models, write or call:



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MARASPERSE*

highly effective, low cost dispersant
(usually in dry powder form)
to reduce viscosity to the desired consistency

Only a little Marasperse is needed to reduce slurry viscosities, or to prevent micron-sized particles from settling out of suspensions. Usually less than 3%, based on the weight of the solids in the aqueous system, will do the job for you.

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Tell us about your viscosity problem. If it's typical of one of the many that the Marasperse dispersants have licked, we'll give you specific information based on user experience. If it's something new or unique, we'll tell you how to test samples of the Marasperses to determine whether or not they'll be useful to you.

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LITERATURE . . .

Canned Pumps......2-page bulletin 1053-1 describes seal-less centrifugal pumps designed for troublefree leak-proof pumping of corrosive and other problem fluids. 272A Fostoria Corp.

Compressor, Piston.....assures absolute contamination-free compression of dry or moist gases. Unique ringless piston & frictionless piston rod. Information & specifications. TL269

*Sulzer Bros., Inc.

Compressors.....Bulletin discusses operational and design features of packaged compressors that are offered in 10 and 12 cylinder models rated at 825 and 1000 bhp.

272B Clark Bros. Co.

Compressors, Centrifugal.....Model G centrifugal comp.essors are available in capacities from 500 to 15,000 cfm, for 4 to 20 psig duty on air service. Bulletin 2564-11. 83 *Joy Mfg. Co.

Pneumatic Equipment.....Rotary air motors, compressors and vacuum pumps for low-cost solutions to your problems. "Application Ideas" booklet & catalog are offered. TR250 *Gast Mfg. Co.

Pump, Diaphragm.....for those hardto-handle fluids; corrosive, abrasive, viscous, thick, heavy, etc. Easy to clean. Bulletin 148 is available. Send for your copy. L270 *T. Shriver & Co., Inc.

Pumps.....for hard-to-handle liquids in the chemical industry. Pumps range from 25 to 2500 hp., pressures to 50,000 psi. Additional information is available. 156 *Aldrich Pump Company

Pumps......Acid pumps, centrifugal and gear types, protected by Ace Hard Rubber are described in Bulletin CE-55 which is available on request. 149°C *American Hard Rubber Co.

Pumps....Parts are standardized and readily interchangeable. Plant expansion is economical because of their adaptability. Complete descriptive lit. available.

63 *The Deming Co

Pumps.....satisfy virtually all pumping requirements and feature higher speeds, non-overloading power characteristics and steep head-capacity stability. Booklet. 222 *Johnston Pump Co.

Pumps.... Type CWO-C vertical shaft centrifugal pump is available in sizes from 1" to 16" capacities. It is easy to maintain. Details are given in Nagle Pump Selector. TL289 "Nagle Pumps, Inc.

Pumps.....Before deciding on type of pumps, see Bulletin V-837, describing the vertical pump, and Bulletin C-355, describing horizontal pump to avoid costly misapplication. 1284 "Taber Pump Co.

Pumps, Acid.....with rugged, simple frame construction & packingless design. Long wear parts, few in number, are available in a variety of metal alloys as well as plastic. 293 *A. R. Wilfley & Sons, Inc.

Pumps, Centrifugal.....New catalog 130 describes 50 different models. Offer pressures: to 21 psi. in single stage pumps; to 70 psi. in multistage types. 80 "Eastern Industries Inc.

* From advertisement, this issue

NOW FISHER LEVEL-TROL®



Features external adjustment for proportional band and liquid level height. Extreme simplicity in design. Silicon transistors and diodes... no vacuum tubes. No additional parts to reverse action. Line voltage fluctuation has negligible effect.





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W. DAHL . G. W. DAHL . G. W. DAHL . G. W. DAHL . G. W. DAHL

LOW COST VALV **BY-PASS VALVES**

W. DAHL

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3

Dahl DEMI Miniature Packless Valves offer great porting versatility in isolating, routing and by-pass applications. For example...three-way manifold, used across a flow metering, differential sensing device allows it to be zeroed or isolated from line for test . . . reducing size and cost of installation.

Patented basic design offered in fortý-three styles . . . with metal-to-metal seating, TEF-LON seats, or neoprene dia-



phragms . . . all featuring bubble tight shut-off.

Low cost "DEMI G" valves, in 1/8" to 1/2" N.P.T. sizes, provide positive control in minimum space. Many actuating devices. Wide selection of construction materials.

REQUEST free 32-page Catalog D-1 for complete details. G. W. Dahl Co., Inc., 84 Tupelo St., Bristol, R. I.

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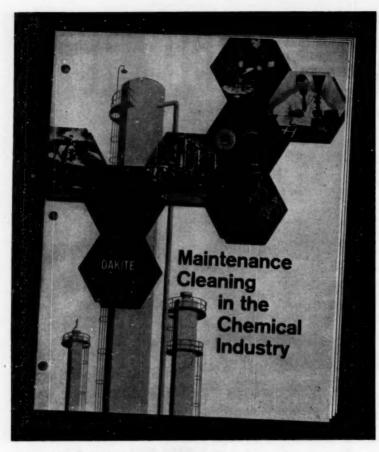
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Hardinge Millis: 3" x 8" x 3" x 2" & 4" x 2" x 2"
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36", 30" x 36", 48" x 9", 10" x 20", 14" x 22", 18" x
36", 30" x 36", 48" x 90", 48" x 22", 8" x 3", 6" x 8"
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- 2-Bird 24" x 38" Solid Bowl Continuous 304 5.5.
- -Bird 36" x 50", Solid Bowl, Continuous, 347 55
- 1-Bird 40" x 60" Solid Bowl Continuous, 316 S.S. unused. 3-Sharples PY14, PN14 Super-D-Canters
- 2-Fletcher 48" Suspended 316 S.S. Per-
- forated Basket. 2-Sharples #16, 304 S.S., 3 HP motor.

REACTORS-EVAPS CONDS-TANKS

- 1-100 gal. 304 S.S. jacketed agitated Re-
- 3-Pfaudler 200 gal. glass lined jacketed Kettles.
- 1-300 gal. Hastelloy B jacketed Kettle.
- 1-650 gal. 304 S.S. Reactor with 100 sq. ft. Bayonet Heater.
- 1-550 sq. ft. Buflovak monel single effect Evaporator
- 1-500 gal. S.S. Mixing Tank with nickel
- 6-7500, 6000 and 2000 gal. Rubber Lined
- 1-10,000 gal. rubber lined Tank 10' x 1-1500 gal. Stainless Pressure Tank, 5' x
- 10' 90#
- 1-2,000 gal. horiz. 304 S.S. tank, 5' x 12'. 1-2500 gal. vertical 304 S.S. Tank, 8' x 7'.
- 1-12,000 gal. horiz. steel Pressure Tank, 7'6" x 36', 200 psi.
- 2—Glascote 26 sq. ft. glass lined jacketed Condensers, UNUSED.
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- coat Filter. 1-U.S. 200 sq. ft. 304 S.S. Auto-Jet Filter. 1-Hercules 400 sq. ft. 304 S.S. Pressure
- 1-Oliver 5'3" x 8" Steel Rotary Vacuum, vaportite housing.
- 2-Feinc 3' x 1' and 3' x 3' Stainless Steel Rotary Vacuum Filters, string discharge. 1-Feinc 5' x 6' Stainless Steel Rotary
- Vacuum Filter. 2-#12 Sweetland Filters, 36 leaves, 4"
- centers, 500 sq. ft. 2-#10 Sweetland Filters, 27 leaves, 4" centers, 250 sq. ft.

DRYERS

- 1-Buflovak Vacuum Shelf with 17-60" x 80" shelves.
- 2-Buflovak 42" x 120", atmospheric double drum Dryers, complete. 1—Buflovak 32" x 90" Atmos. Twin Drum
- Dryer.
- 2-Devine 4' x 9' single drum, atmos-
- -Buflovak 3' x 10' Rotary Vacuum Dryer. 1-Baker Perkins 5'6" x 6' Rotary Vacuum
- 6-Louisville Rotary Steam Tube 5' x 25', 6' x 30', 6' x 50'.
- 2-Louisville 8' x 50' Stainless Steel lined
- Rotary Dryers. -Rotary Dryers 34" x 30', 4' x 40', 6'
- x 50', 6' x 60', 7' x 80', 8' x 87'. 1—Louisville 41/2' x 25' Inconel Rotary
- 2-Link Belt, 7'5" x 25', 6'4" x 24", 5.5.
- Louvre Dryers.
 1-Stokes model 38-A Tray Dryer with 16-36" x 36" S.S. Shelves.
- 2-Atmos. Tray Dryers, 16 shelves, 40"x24"
- 1-P&S 6' wide Apron Conveyor Dryer 48' long.
- 2-10' and 4' dia. 304 S.S. Spray Dryers. 2-Wyssmont Dryers, 304 5.5. 6'2" and 9'6" dia.

MIXERS

- 1-Abbe 110 gal. 304 S.S. Jacketed Agitated Vacuum Dispersall Mixer.
- 2-Day Imperial 150 gal. jktd. double arm. 2-Baker Perkins 150 and 100 gal. jack-
- eted double arm Sigma blades. 1-Baker Perkins 50 gal. jacketed, double-
- "Cincinnatus" double arm. 250 5-Day "Cincin and 100 gal.
- 2—Steel jacketed Powder Mixers, 225 and
- 350 cu. ft. 1—Patterson 6' dia. Conical Blender 15 HP.
- 1-3' dia. Simpson Intensive Mixer. 1-2' dia. Simpson Intensive Mixer 304
- 1-45" dia. Lancaster Mixer 71/2 HP motor. 1-Patterson Kelly 150 cu. ft. Twin Shell
- Blender. 1-Sprout Waldron 1500# 304 S.S.
- Powder Mixer, 15 HP motor.

MISCELLANEOUS

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- 2-Hardinge 5' x 22" steel lined conical Ball Mill
- 4-Mikro Pulverizers 4TH, 1 SH, 1 SI and
- 3-Abbe 21/2" x 3' porcelain lined Pebble Mill XP motor.
- 1-Raymond 10" vert. Mill, 10 HP.
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- 1-#18 Cumberland Rotary Cutter.
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- 5-Day Roball Sifters, 40" x 120", 40" x 84", Double Deck.
- 3-Nash Hé Vacuum Pumps.
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- -Fletcher 30" under driven "Junior" Stainless extractor
- 1-Gemco 60 cu. ft. cone blender, SS 1-Allis-Chalmers 5' x 5' ball mill.
- -F. J. Stokes #138-J6 vacuum shelf dryers, 16 shelves 40" x 44", 195 sq. ft.
- -Valley 36" aluminum P. & F. filter presses, 65 chambers, closed delivery, hydraulic closure.
- Vulcan 60" dia. x 35 plate T316SS bubble-cap column, 42' high,
- -Hardinge 8' x 48" conical pebble mill, air swept, classifiers.
- -Buflovak 32" x 52" double drum dryer, ASME 100# WP.
- American 42" x 120" double drum dryer, ASME, stainless trim.
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KETTLES—REACTORS

- -1800 gal. T316SS reactor, vacuum internal, new jacket.
- -1350 gal. T347SS Kettles, open top, paddle agitators.
- -1000 gal. Dopp cast iron Kettle, 125# jacket, 15# int., 25 HP TEFC Agit.
- -750 gal. Graver T304SS jkt. fer-menter, ASME 30# int., 30# jkt., 10 HP Turbine Agit.
- -600 gal. Bartlett & Snow SS evap. & crystallizing ikt. Kettle.
- 1-600 gal. T304SS reactors, Jkt., Agit.
- 2—500 gal. T304SS reactors, jacketed, ASME, Vacuum—Unused.
- 465 gal. to T304LSS reactors, jacketed, 150# int., 175# Jkt.
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- 1—300 gal. Pfaudler blue G/L reactor, Agit., Jkt., ASME.
- 1-300 gal. Glascote blue G/L reactor, Agit., Jkt., ASME.
- 2-125 gal. T316SS Jkt. fermenter.
- 1-30 gal. Pfaudler G/L reactor.

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COLUMNS - CONDENSERS

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- Buflovak double-effect stainless evap. vert. long-tube type: 1025, 840, 710, 588 sq. ft.
- 1-Stokes 118 sq. ft. T316SS U-tube
- -Bartlett & Snow 6' dia. Stainless jkt. evap.-crystallizing kettle.
- -Vulcan 110" dia. x 16' high T316SS bubble-cap column, 10 trays.
- 1-96" dig, x 44' high steel beer still.
- -Vulcan 60" dia. x 42' high T316SS bubble-cap column, 35 trays.
- -96" dia. x 44' high steel beer still. cap column, 10 trays.
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PRESSES

- -Davenport #1A dewatering presses.
- -Davenport #2A dewatering presses.
- 2-Davenport #3A dewatering presses.
- 2-Komarek 160,000 PSI briquette presses.
- -French Oil #2-S screw type extrac-tion presses, 300 PSI, 60 HP.
- 2-Stokes #DDS-2 rot. tablet presses. -Stokes #RD-3 rot. tablet press.
- 1-Stokes #T single punch press.

- Shriver 48" C.I. P&F filter presses, 1000 sq. ft., closed delivery -Valley 36" aluminum P&F filter presses, 65 ch., closed delivery. -Sweetland #12 filters, (72) stainless
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- Bonnot rotary cooler, 8' x 50', complete
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- Buflovak stainless steel rotary vacuum dryers, 5' x 30'
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- -Buflovak SS jacketed rotary vacuum dryer, 3' x 15'
- Stokes SS jacketed rotary vacuum dryer, 3 x 15 -Stokes SS jacketed rotary vacuum dryer, 3 x 15 and 2 x 6' -American 42" x 120" double drum dryer, ASME, complete
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 —Sharples type 316 SS Super-D-Canter, PN-14, complete
 —Sharples type 316 SS centrifuges, Model D-2

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- Oliver SS rotary vacuum pressure precoat filter, 5'3" x 8'
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- and too he moor -J. H. Day 5 gal. double arm sigma blade mixer, SS -Stokes stainless steel granulating mixer, Model 21-J -Colton stainless steel granulator, Model 561-S

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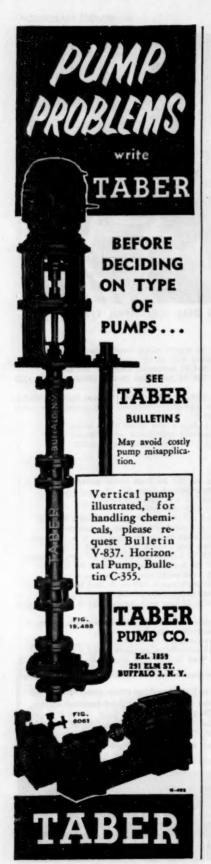
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- Mikro #3TH SS pulverizers, complete
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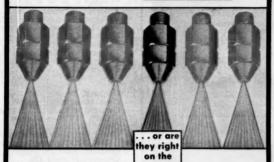
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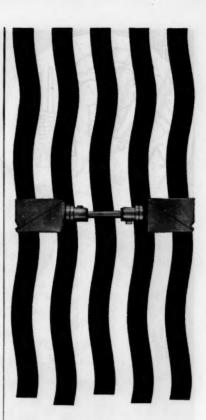
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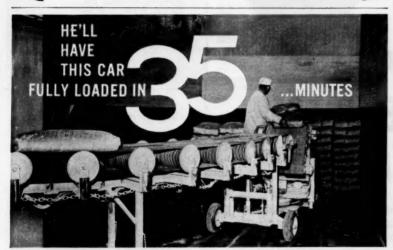
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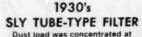
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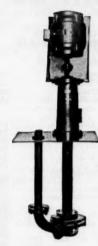
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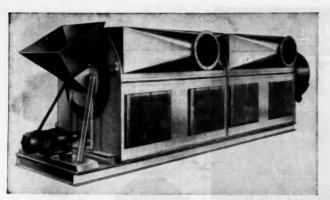
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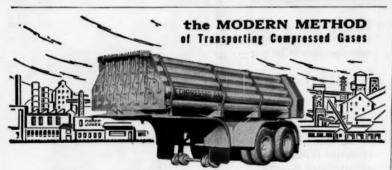
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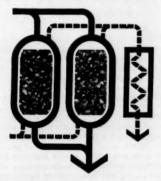


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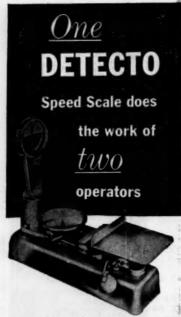
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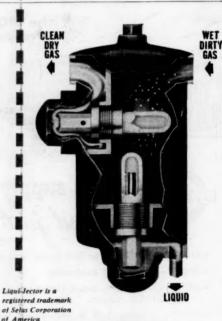
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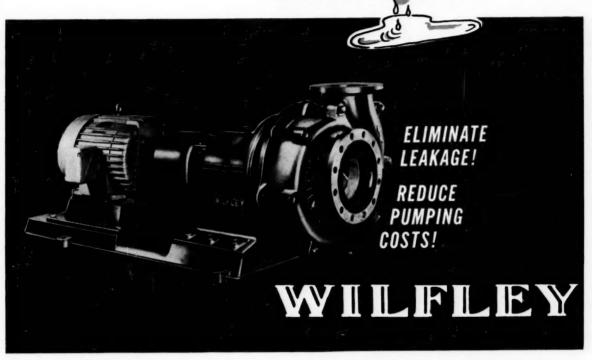
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